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North Carolina Department of Transportation
Statewide Planning Branch
Systems Planning Unit

Thoroughfare Plan

For

TOWN OF
19 11
LAKE WACCAMAW

April, 1996

Thoroughfare Plan
for the
Town of Lake Waccamaw

Prepared by the:

Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In Cooperation with:

The Town of Lake Waccamaw
Columbus County
The Federal Highway Administration
US Department of Transportation

Blake Norwood, P.E.
Urban and Systems Studies Group Manager

April 1996

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Acknowledgements

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Chapter 1

INTRODUCTION

The first written account of Lake Waccamaw was made by John Bartram, a botanist serving King George III. The Waccamaw Indians first occupied the land. The area was colonized in 1745 by John Powell, but became the village of Flemington in 1846 with the grant receipt for land west of Waccamaw by Josiah Maultsby. The village was renamed Lake Waccamaw in 1890 with a population of 50 people, a hotel, post office, and other businesses. In 1898, Frances Beers Gault came south from Minnesota to join his Uncle Charles Oscar Beers and Henry Bascom Short in the lumber and shingle business and became the principal stockholder in the organization. Gault reorganized the company as the North Carolina Lumber Company. By 1920, this company was valued at a half million dollars. From 1924 to 1925, Mr. Gault built Flemington Hall, expecting it to become his own home. This home is now the office for the Boys Homes of North Carolina, a non-sectarian home of Christian environment for neglected, underprivileged, and homeless boys.

Lake Waccamaw covers nearly 9000 acres and has been developed as a modest resort. Some geologists believe Lake Waccamaw belongs to the Landen Lake group formed by meteorites. Dredges have brought up old charred tree stumps, and they support a theory that the lake is the basin left by a prehistoric peat fire. Lake Waccamaw has a dam (serving to keep the lake's size during a drought) that was built by the state in 1926. It has four feeders: First Little Creek, Second Little Creek, Third Little Creek, and Big Creek.

Lake Waccamaw's population has increased over the years, but still remains as a rural recreational community with tourism more than doubling the town's population during the summer months.

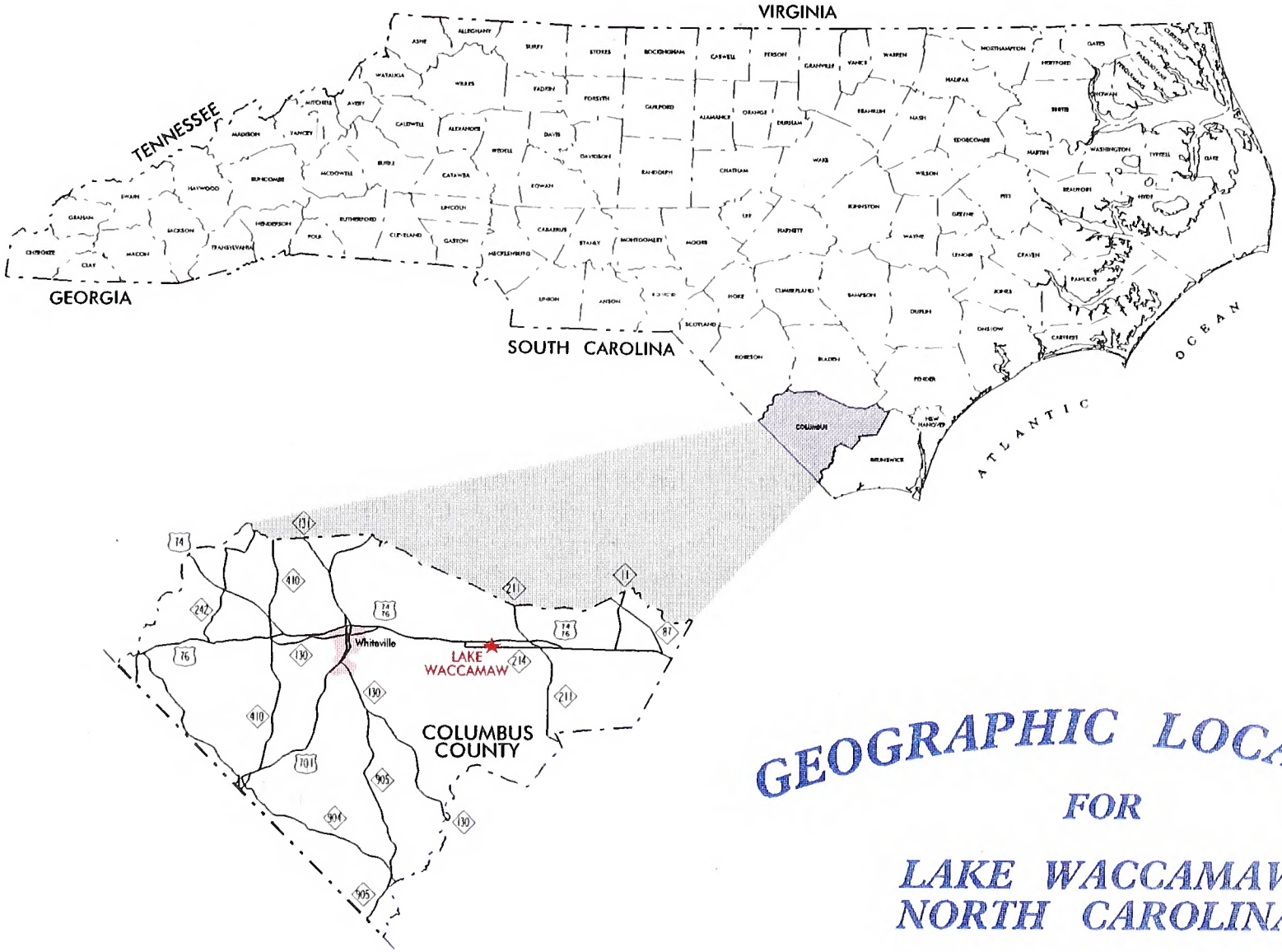
In October 1991, the Town of Lake Waccamaw asked the NC Department of Transportation to review their highway system and update the thoroughfare plan for the area. This update takes into account the concerns of the Town of Lake Waccamaw in addressing the patterns of future growth. Thoroughfare plans are created to insure transportation system efficiency development through a cohesive, coordinated system of roads and highways. The principles of basic thoroughfare planning are outlined in Chapter 6 of this report.

The recommendations are based on general traffic, population, and land use data. Year 2020 average daily traffic projections were used to determine capacity deficiencies. These projections were found using a trend-line analysis. Major and minor thoroughfares were located based on existing and anticipated land uses, field investigation, and topographic conditions. The State worked

cooperatively with the Town to develop the plan. The geographic location of Lake Waccamaw is shown in Figure 1.

The recommended plan is based on anticipated growth of the urban area. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.

The purpose of this report is to document the study findings and recommendations. Included are recommendations for thoroughfare cross-section, cost estimates and benefit evaluations for recommended improvements, and plan implementation recommendations.



GEOGRAPHIC LOCATION FOR LAKE WACCAMAW NORTH CAROLINA

FIGURE 1

Chapter 2

POPULATION, LAND USE, AND TRAFFIC

Population Trends

Travel is directly related to population. The traffic on any roadway is related to the size and distribution of the population served. A basic step in planning a transportation system is conducting a population study. This enables the planner to forecast a logical future population and its distribution. Using historic trends and other State agency estimates, a design year population was estimated. It is estimated 2,605 full time residents will be in the Lake Waccamaw Planning Area by the year 2020.

Most of the Lake Waccamaw traffic originates outside the immediate area on US 74-76. It consists of work and recreation travel to and from the cities of Whiteville, Wilmington, and Lumberton, and Brunswick and New Hanover counties. Population trends and projections for the thoroughfare planning boundary and surrounding townships are shown in Table 1. Table 1 indicates no rapid population increase expected in Lake Waccamaw. However, the planning area traffic will increase over the next thirty years. US 74-76 Bypass will provide the capacity to handle additional through traffic throughout the planning period. The possible addition of Interstate 73 through Columbus County (partially using US 74-76) may increase the traffic in the planning area. The downtown area and the lake front will only experience congestion problems during summer holidays and weekends.

Economy and Employment

Lake Waccamaw is considered as the recreational center of Columbus County. The lake offers water recreation during the summer plus fishing during the remaining part of the year. The lake is the largest of the natural Carolina Bay Lakes with a total surface of 8936 acres. The Lake Waccamaw State Park, which includes the lake, has an total area of 10,644 acres.

Council Tool Company is the largest employer in the town, followed by Tops Tobacco Company. Twenty-eight other businesses exist in the area (information: April 1992 Community Development and Land Use Plan). Lake Waccamaw does not have detailed economic information available.

Information given by the USA Counties CD-ROM (US Department of Commerce, Bureau of the Census, 1994) shows a slight increase in Columbus County employment over the past 10 years. There has, however, been a dramatic decrease in agriculture employment of 38% from 1978 to 1987. The agriculture/

Table 1
POPULATION TRENDS AND PROJECTIONS
Lake Waccamaw: Columbus County and Surrounding Townships

	Columbus County	Bogue Twp	Bolton Twp	Waccamaw Twp	Lake Waccamaw	Planning Boundary (Created 1995)
1960	48,973	3,463	1,566	1,366	780	-----
1970	46,937	2,896	1,506	1,456	924	-----
1980	51,037	3,135	1,876	1,971	1,133	-----
1990	49,587	2,975	1,599	1,946	954	-----
1995*	49,686	2,900	1,605	2,065	986	2,227
2000*	49,786	2,827	1,610	2,190	1,020	2,291
2010*	49,985	2,686	1,622	2,465	1,090	2,436
2015*	50,085	2,618	1,627	2,616	1,127	2,517
2020*	50,186	2,552	1,633	2,775	1,166	2,605

* These populations are projections found through a trend-line analysis.

non-agriculture employment ratio has decreased significantly due to a nationwide trend toward mechanization and fewer family-owned farms.

The forestry resources in Columbus County have been utilized for years. Principal commercial species now are pine (some longleaf, mostly loblolly), gum, oak, cypress, and bay or pond pine (an inferior tree that grows in swampland in the highlands). The Riegel paper plant at Acme (on the Cape Fear River, northeastern corner of the county) was one of the large forestry companies developed from this timber growth. The W.N. Ritter Lumber Company of Columbus, Ohio was the other industry; it is located at Hallsboro and Lake Waccamaw. (Surrounding the town of Lake Waccamaw are tracks of land owned by International Paper, Georgia Pacific, and Federal Paper Board, three large forestry industries.)

Columbus County, centered in a populous section for over two centuries, still remains one of the best game areas in the South. A population of deer, bear, and smaller species has been preseved in this area through natural protection of swampland and intelligent conservation from individual land owners.

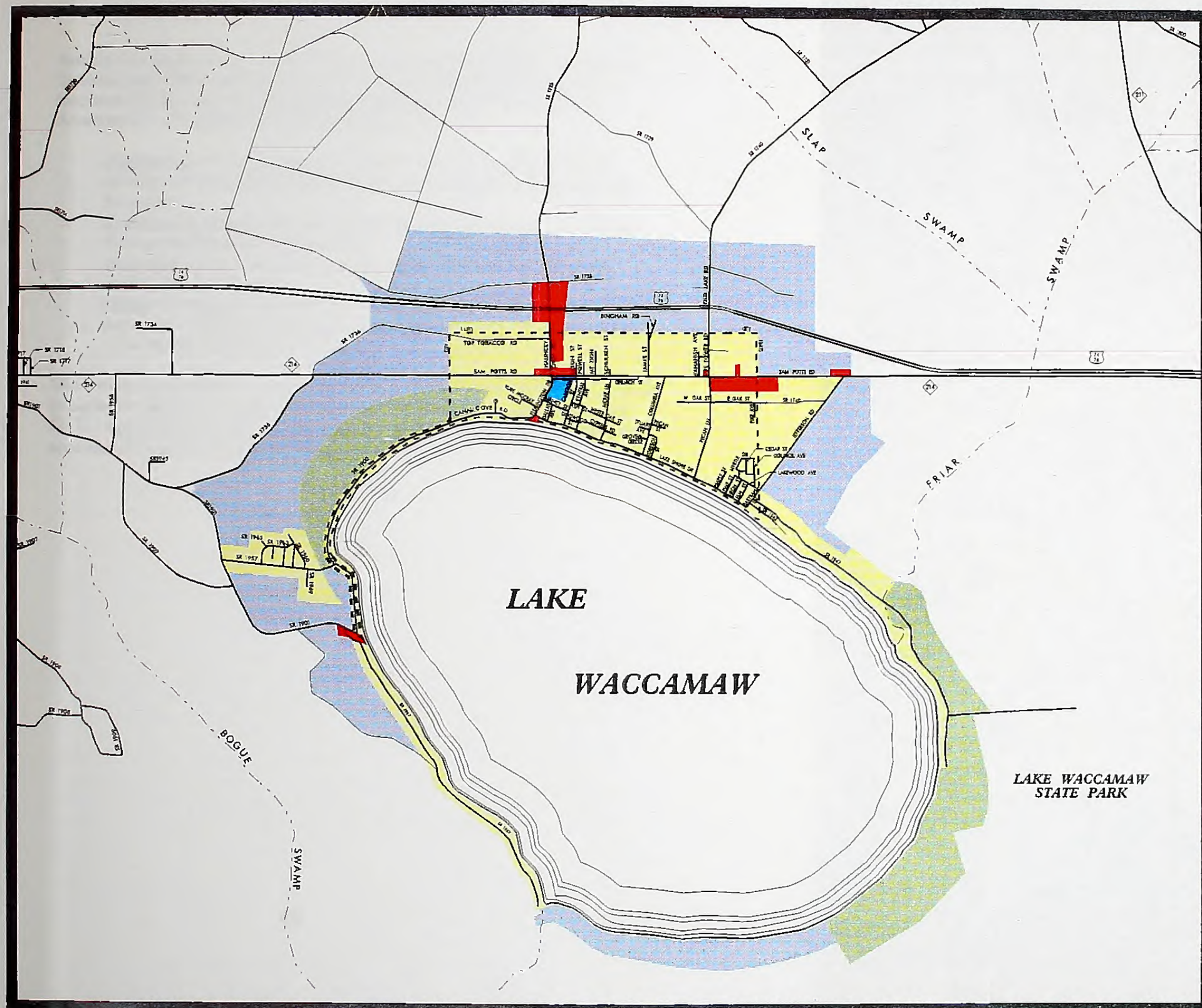
Land Use

Land use refers to physical patterns of activities and functions within an area. Nearly all traffic problems are relative to the land use in a specific area. For example, a large industrial plant might be the cause of congestion during shift change hours. However, a few problems can occur as the day progresses. The spatial distribution of different land use types (sometimes referred to as traffic generators) is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

For use in transportation planning, land uses are grouped into four categories:

(1) Residential—all land devoted to the housing of people excluding hotels and motels;
(2) Commercial—all land devoted to retail trade including consumer & business services and offices;
(3) Industrial—all land devoted to manufacturing, storage, warehousing, and transportation of products;
(4) Public—all land devoted to social, religious, educational, cultural, recreational, and political activities.

Figure 2 shows the planning area's existing land use.



LEGEND

- RESIDENTIAL
- RECREATIONAL
- COMMERCIAL
- INDUSTRIAL
- OFFICE/INSTITUTIONAL

SCALES

0 2000 4000 6000

FEET

0 1 2 3

KILOMETERS

EXISTING LAND USE FOR LAKE WACCAMAW

FIGURE 2

COLUMBUS COUNTY
NORTH CAROLINA

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

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FEDERAL HIGHWAY ADMINISTRATION

Anticipated land use is a logical extension of the present spatial distribution. Determining where expected growth is to occur within the planning area facilitates the location of proposed thoroughfares. Areas of anticipated development and growth for Lake Waccamaw are:

> Residential—A large amount of Lake Waccamaw residential land development should be located to the west and north of the planning boundary.
> Commercial/Retail—All commercial development is expected to exist throughout the planning boundary.
> Industrial—Any industrial development is expected to occur north of the planning boundary.
> Public—No significant public development is expected in the planning boundary. More recreational events may occur on the lake, but no new recreational buildings are expected.

The western and northern portions of the planning area have the largest growth expectations and are served by a number of major routes, one of which is US 74-76. Very little development can occur due to the swampland engulfing the area east and south of the planning boundary.

Chapter 3

RECOMMENDATIONS

The following is a list of roads recommended as major or minor thoroughfares as discussed in Chapter 6. Deficiencies and functions of each road are included to support its classification as a thoroughfare. More detail on physical and operational characteristics is given in Appendix B. The recommended thoroughfare plan is shown in Figure 3 .

Many two-lane facilities in the area have lane widths less than 3.66 m (12 feet). Roads with these type of lanes should be widened to 3.66 m for safe and adequate operation. These facilities are also given in Appendix B .

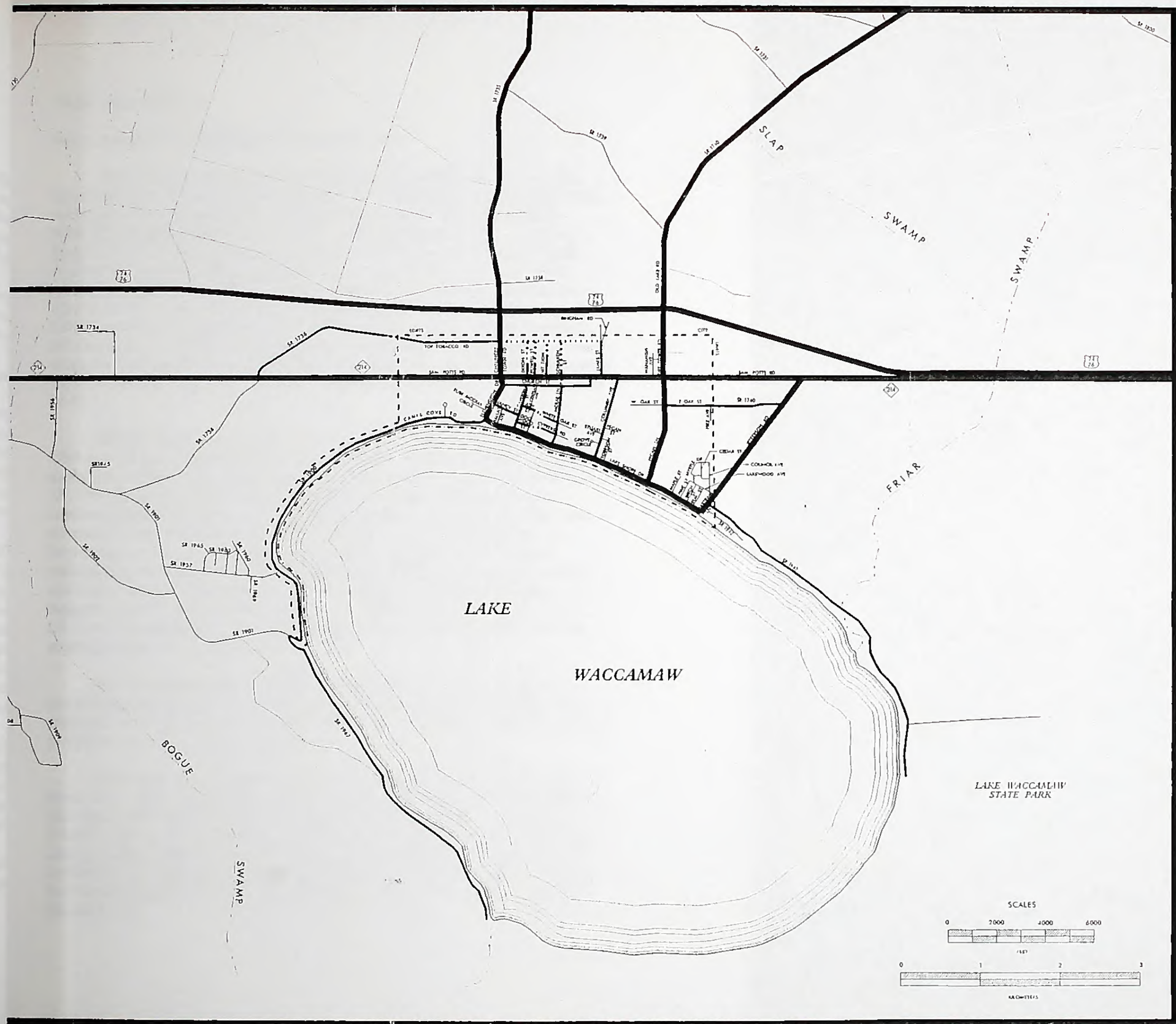
Existing Major Routes

The primary routes serving Lake Waccamaw are US 74-76 and NC 214. The town is also served by SR 1757 (Lake Shore Road), SR 1900 (Canal Cove Rd), SR 1947 (Bella Coola Road), and SR 1967 (Waccamaw Shore), which all circumvent the northwestern arc of the lake. Several streets run north-south from the lakefront to NC 214. Other thoroughfares lie west of the lake but intersect the lakefront roads.

US 74 is part of the NC Intrastate Highway System funded under the Highway Trust Fund Law enacted in July 1989. US 74 is an east-west corridor that has vital importance to the southern area of NC. The highway connects Charlotte (the state's largest city) to Wilmington (the largest port) and carries a significant volume of commercial traffic. US 74 also adds to the state's tourism by linking the Southern Piedmont to the southeastern beaches. The road links I-85 and I-95, as well as the cities of Charlotte, Monroe, Wadesboro, Rockingham, Laurinburg, Lumberton, and Wilmington. US 76 begins at the NC shore (near Wilmington) and weaves west through Columbus County (along US 74) towards Florence, SC.

NC 214 is the other primary route in Lake Waccamaw. The route formerly began just north of Lake Waccamaw and continued south from US 74-76. The road has been re-routed since 1990 as follows: it traverses east from US 74 Business near Whiteville, through Lake Waccamaw, to finally intersect NC 211 at the town of Bolton.

All thoroughfares in the planning boundary are two-lane facilities, with the exception of US 74-76, which is a multilane facility. These are shown in Figure 3.



LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE	▬▬▬	▪ ▪ ▪ ▪ ▪
MINOR THOROUGHFARE	———	- - - - -

N
S

ADOPTED BY:

CITY OF LAKE WACCAMAW	December 12, 1995
PUBLIC HEARINGS	December 12, 1995
RECOMMENDED BY STATEWIDE PLANNING	M.R. Poole March 20, 1996
NC DEPARTMENT OF TRANSPORTATION	April 12, 1996

REVISIONS:

LAKE WACCAMAW	STATEWIDE PLANNING	N.C. DEPARTMENT OF TRANSPORTATION

THOROUGHFARE PLAN FOR LAKE WACCAMAW

APRIL 12, 1996

COLUMBUS COUNTY
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Major Thoroughfares

Existing major thoroughfares include the following:

US 74-76 is a four-lane facility traversing from Wilmington to a point approximately 10 miles west of Whiteville. This facility bypasses the old US 74 route (now NC 214) and the town of Lake Waccamaw. This thoroughfare through Columbus County is part of the North Carolina Intrastate Highway System. The NC Transportation Improvement Program (TIP) Project R-2558 (widening US 74-76 from a two-lane to a four-lane facility) was modified to create a new US 74-76 path north of the original route. (Further explanation on the NC Transportation Improvement Program can be found in Chapter 6.) This construction was completed in 1987. Interstate 73 is a new interstate highway scheduled to run between Detroit, MI and Charleston, SC. I-73 could be routed along the existing US 74-76 during the planning period, increasing the amount of traffic in the planning area. However, no new improvements are needed for US 74-76.

NC 214 has changed routes many times in the past ten years. The route in 1985 entered the town of Lake Waccamaw southward from US 74-76, eastward along the northern edge of the lake, and continued northward back to US 74-76. The 1987 completion of the new US 74-76 route changed NC 214 to begin southward from US 74-76, proceed in a zig-zag manner through the town, and return to the old US 74-76 route. In 1994, NC 214 was further rerouted, beginning approximately one mile east of the Whiteville East City Limits, continuing east through the towns of Hallsboro, Artesia, and Lake Waccamaw, and intersecting US 74-76 about two miles east of Lake Waccamaw. The majority of the route has 6.71 m (22 ft) width. Increasing this width to 7.32 m (24 ft) would adequately carry any traffic produced along the current NC 214 routing during the planning period.

SR 1735 (Chauncey Town Road) begins at NC 214 and extends north towards Bladen County. In the process, the route crosses US 74-76 and serves local and some Bladen County traffic along the abutting farm lands. No capacity problems will occur on this thoroughfare.

SR 1740 (Pecan Lane/Fire Tower Road/Old Lake Road) begins along Pecan Lane. (The road exists between a bountiful growth of pecan trees, hence the name.) This section of the route appears narrow, although its width is 5.49 m (18 feet). This northbound route crosses NC 214, is renamed Fire Tower Road, and continues to the north town limits. The road is renamed Old Lake Road at the town limits. The route continues north, crossing US 74-76 and continuing to the eastern part of the county. No capacity problems are anticipated on this thoroughfare.

SR 1757 (Lake Shore Drive) is the access point for the eastern portion of the lake until its intersection with Bartram Lane. Homes are located across the road from the lake, giving little right-of-way for the road. During the summer months and holiday weekends, vehicles must compete with pedestrians and bicycles along this facility. The shoulders of the road are from 0.31 to 1.22 m (1 to 4 feet) in width. Their width keeps walkers or bikers from competing with vehicular traffic. The proximity of the homes near the roadway restricts widening for additional pavement or a walkway. A wider pavement is still recommended along this route.

SR 1757 (Bartram Lane/Jefferson Road) intersects the eastern end of Lake Shore Drive, veers north, and intersects NC 214. This street is the most important eastern access point to the lake from NC 214. It is a two-lane facility that should not experience vehicular capacity problems.

SR 1900 (Flemington Drive) begins at the intersection of NC 214 and SR 1735 (Chauncey Town Road) and ends at the intersection of SR 1900 (Canal Cove Road) and SR 1757 (Lake Shore Road). The road begins at NC 214 with a width of 16.77 m (55 feet), and narrows down to 5.49 m (18 feet). Municipal offices exist on the east side of the road; homes are located on its west side. No capacity problems are anticipated on this facility.

Other projects include:

NC 214/SR 1735/SR 1900 Intersection Improvement: This dog-leg intersection should be realigned for improved safety.

SR 1757 (Lake Shore Drive) requires continuous maintenance of the roadway due to its low elevation and tree roots upsetting the pavement. Homes are located across the roadway, limiting the right-of-way of the route if widening were needed. Maintenance problems arise because of the large tree roots that disturb the pavement width, causing it to buckle. A wider pavement is still recommended along this route.

Minor Thoroughfares

Existing minor thoroughfares include:

SR 1736 (Top Tobacco Road/Giles Byrd Road) begins south of Hallsboro and continues eastward. After intersecting with NC 214, the route meanders northeast as a dirt road and ends at SR 1735. The road also changes names at the NC 214 intersection. The unpaved, two-mile section of this secondary route is currently on the NCDOT District Priority Paving List for recommended paving. This section is approximately 3.66 m (12 feet) wide and has drainage ditches. The proposed **Top Tobacco Road Extension** provides a connector for the northern remote area of the town without accessing NC 214. It would also give a better east-west flow for residences and provide access to lands for future uses. Access to new lands would be provided for residential development. This extension to the east will be a paved continuation of the present two-lane rural-type facility. No capacity problems are expected on the existing paved portion.

SR 1738 (Georgia Road) lies north of US 74-76 and begins at SR 1735, traversing eastward. The dirt road serves abutting farm lands and residences. This secondary route is currently on the NCDOT District Priority Paving List for recommended paving. There will be no capacity problems on the existing paved portion.

SR 1739 (Ben Jones Road) is a dirt facility north of US 74-76 that connects SR 1735 and SR 1740. The route serves residences and agricultural areas. This secondary route is currently on the NCDOT District Priority Paving List for recommended paving. There will be no capacity problems on the existing paved portion.

SR 1740 and East Oak Street is a continuous road from SR 1757 (Jefferson Road) to Pecan Road. The unpaved section of this secondary route is currently on the NCDOT District Priority Paving List for recommended paving. A wider pavement of 6.10 m (20 feet) is recommended for safety reasons for the section of SR 1740 within the town limits (East Oak Street).

SR 1900 (Canal Cove Road) is a narrow two-lane facility (6.10-m (20-ft) pavement) that goes around the western portion of the lake on a narrow strip of land between the lake and Cove Swamp. SR 1900 becomes Canal Cove Road at the intersection of SR 1900 (Flemington Drive) and SR 1757 (Lake Shore Road). The thoroughfare ends at the SR 1901 (Dupree Landing Road)/SR 1967 (Waccamaw Shore) intersection. Permanent and seasonal homes jut out into lake front property with driveways every few feet like a residential street. Across the road lies Cove Swamp with a 3.66 to 6.10 m (12- to 20-foot) drainage canal that gives the appearance of stagnant swamp water. The lake front homes are at a

lower elevation than Lake Shore Drive and have the same problems with pedestrian and vehicle travel. The road requires continuous maintenance, but at a greater need due to the narrow strip of land on which the road rests. Drainage problems occur frequently along the road because it is only one foot above sea level. Cove and Bogue Swamps lie across the road from the lake making drainage ditches for the roadway virtually impossible. Drainage pipes lie under the roadway for any overflow from the lake to the swamp; however, they are clogged frequently because of debris and the elevation. Homes are located between the swampland and lake; there is not enough dry land available for proper maintenance and widening of the roadway. The ideal situation would be to widen the existing pavement from 6.10 to 7.32 m (20 to 24 feet) with bike lanes as part of the shoulder. Raising the height of the road would help drainage problems, but the short distance from the pavement to each residence would make for a steep driveway.

SR 1947 (Bella Coola Road) begins at Bartram Lane and continues around the eastern shore of the lake serving permanent and summer homes. Green Swamp and Big Creek (which feeds Lake Waccamaw) lie north of SR 1947. This secondary road is a two-lane facility with right-of-way being more accessible for future widening or a walkway than SR 1757 or SR 1900. The Lake Waccamaw State Park is accessed near the end of SR 1947. Average daily traffic is less than 500 on this facility, but will probably experience more traffic with recent improvements to the Park. No capacity problems exist on this route.

SR 1967 (Waccamaw Drive) begins at the intersection of SR 1901 and SR 1900 and continues around the western portion of the lake. Bogue and Lake Swamps lie near the southern tip of this route. This facility gives access to abutting permanent and summer homes along the lake front; vehicle and pedestrian traffic is experienced during peak periods. With the increase of homes built along this road, the chance for future improvements for the road has somewhat diminished. The roadway is, however, wide enough to accommodate future traffic without experiencing any capacity problems.

James Street, Church Street, Cameron Street, and McRae Lane, and Columbia Avenue. Each of these thoroughfares are two-lane collectors. There are no foreseeable capacity problems on these facilities during the planning period.

White Oak Street, Dogwood Street, Cypress Road, Lakeview Avenue, Ash Street, Central Avenue, Nancy Street, Dallas Avenue, Maple Street, Pine Street, Birch Street, Elm Street, Lakewood Avenue, Myrtle Drive, Cedar Street, Vine Street, Council Avenue, Holly Street, Brigham Road, Pike Avenue, West Oak Street, Pecan Street, Robeson Street, & Wananish Avenue. These are the local access streets throughout the town. Most of these roads have widths between 4.88 and 6.10 m (16 and 20 feet). It is recommended that those roads with a width below 5.49 m (18 feet) be widened to that width for safety reasons and driver comfort. The town is responsible for this work.

There are six proposed minor thoroughfares for the planning area:

--as a rural facility, Top Tobacco Road Extension from the SR 1736/ SR 1735 intersection east to James Avenue
--Dixon Street extension
--Powell Street extension
--Mt. Zion Street extension
--White Oak Street extension
--Cypress Road extension
--Schulken Street extension

The last six proposals are listed as urban facilities. The White Oak Street Extension is to cross west to Ash Street. The Cypress Road Extension is to traverse west to Dogwood Street. These extensions would provide other routes for traffic from Cameron Street to McRae. The Schulken Street Extension south from the Top Tobacco Road Extension to Church Street would provide another north-south route for travel from NC 214 to Lake Shore Drive. The Dixon St and Powell St extensions will give those residents another emergency access route if needed. It is recommended these facilities be built with two lanes. The elevation and drainage should dictate whether the intown facilities should be rural or curb-and-gutter sections. The facilities designated as existing minor thoroughfares are adequate to serve the area by getting traffic to the major thoroughfares.

White Oak Street Extension as shown in Figure 3 provides an east-west connection between Cameron Street and McRae Lane without accessing the major travel corridors. Access to new lands for possible residental development is provided. This connection should be a continuation of the existing two-lane facilities.

Cypress Road Extension as shown in Figure 3 provides an additional east-west connection between Cameron Street and McRae Lane without accessing the major travel corridors. Access to new lands for possible residental development

is provided. This connection should be a continuation of the existing two-lane facilities.

Schulken Street Extension as shown in Figure 3 provides a north-south connection between the proposed Top Tobacco Road Extension and Lake Shore Drive without accessing the major travel corridors. Access to new lands for possible residental development is provided. This connection should be a continuation of the existing two-lane facilities.

Chapter 4

TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM

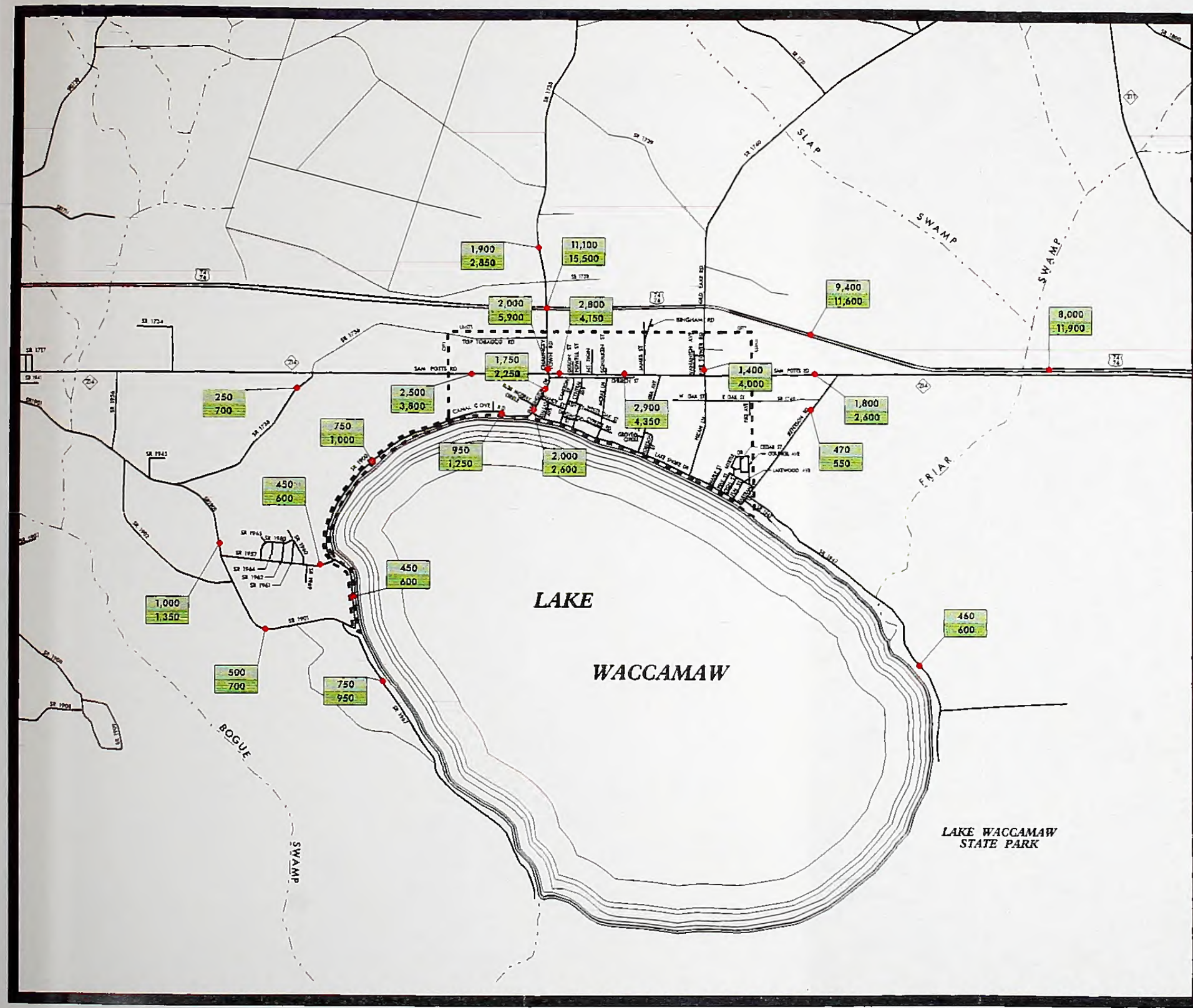
This chapter presents an analysis of the existing street system service to the area travel demand. Emphasis is placed on detecting the deficiencies and understanding their cause. Travel shortcomings may include such things as inadequate pavement width or intersection controls. The underlying problem may even be caused by a *system* deficiency such as need for a bypass, loop facility, construction of missing links, or additional radials.

Travel Demand

Existing major street systems satisfy the travel demand when characteristics of each thoroughfare (i.e., number of lanes, lane and/or road width) allow traffic to move freely at a desirable speed. The travel demand is generally reported in the form of Average Daily Traffic (ADT) counts. Traffic counts are taken regularly on State-maintained roads within the planning area by the North Carolina DOT.

These counts were then compared to the capacity of the roads. Capacity is defined as the maximum amount of traffic to be accommodated by a given facility. Six levels of service are used to define the ability of a road to support a given amount of traffic and whether smooth traffic flow occurs during the day. These levels of service are designated by letters from A to F; level-of-service (LOS) A represents that which allows free flow on the road, and LOS F represents that which hinders movement the most on the road. (Refer to the Capacity Analysis section of this chapter for more information.)

A comparison of annual traffic growth rates from 1985 to 1995 at various count locations in the planning boundary shows average these growth rates ranging from 0% to 12%. The largest growth rate was noticed on SR 1757 (Bartram Lane/Jefferson Road). The large growth rate range is due to the many route changes occurring in the planning area during the last ten years: the new route of US 74-76, the three reroutings of NC 214, and the growth occurring on the outskirts of the town. Figure 4 shows the Average Daily Traffic (ADT) volumes from the design year (1995) to the future year (2020). Table 2 shows existing and expected average traffic volumes based on growth rates for rural areas of 2.5% (moderate growth) to 3.5% (high growth). The projections are based on the growth rates. It is very difficult for a rural area to sustain an annual growth rate over 4% over a 30-year period, and unusual to have one less than 2%. This growth does not include seasonal traffic volumes; the existing and expected seasonal information is shown in Table 3 . Table 3 shows the ADT for an area on



LEGEND

1995	1995 AVERAGE DAILY TRAFFIC COUNT
2020	2020 AVERAGE DAILY TRAFFIC COUNT

SCALES

0 2000 4000 6000

FEET

0 1 2 3

KILOMETERS

TRAFFIC COUNTS FOR LAKE WACCAMAW

FIGURE 4

COLUMBUS COUNTY
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Table 2
LAKE WACCAMAW PLANNING BOUNDARY AVERAGE DAILY TRAFFIC (ADT) VALUES
Major and Minor Thoroughfares

Route	1985	1990	1995	2000*	2005*	2010*	2015*	2020*
US 74-76 (@ SR 1735)	----	9,700	11,100	11,850	12,650	13,500	14,400	15,350
US 74-76 (1 mi E SR 1740)	----	7,200	7,800	8,450	9,150	9,900	10,750	11,600
US 74-76 (2.3 mi E SR 1740)	----	8,600	8,000	8,700	9,400	10,200	11,000	11,900
NC 214 (W SR 1735)	----	2,200	2,500	2,750	2,950	3,200	3,450	3,750
NC 214 (0.1 mi E SR 1735)	----	-----	2,800	3,000	3,250	3,550	3,850	4,150
NC 214 (100 ft E Dixon St)	----	-----	3,050	3,300	3,550	3,850	4,200	4,550
NC 214 (0.05 mi E Powell St)	----	-----	3,000	3,250	3,500	3,800	4,100	4,450
NC 214 (300 ft E Mt. Zion St)	----	-----	2,850	3,100	3,350	3,650	3,950	4,250
NC 214 (0.15 mi E Schulken St)	----	-----	2,900	3,150	3,400	3,700	4,000	4,350
NC 214 (375 ft E James St)	----	-----	4,850	5,250	5,700	6,150	6,650	7,200
NC 214 (E ECL L. Waccamaw)	----	-----	1,800	1,950	2,100	2,250	2,450	2,650
SR 1735 (N SR 1738)	----	-----	1,900	2,100	2,250	2,450	2,650	2,850
SR 1735 (Chauncey Town Rd)	1,300	1,650	2,000	2,500	3,100	3,850	4,750	5,900
SR 1736 (Near WCL L.Wac)*	----	50	100	150	150	150	200	200
SR 1736 (0.7 mi E WCL L.W.)*	----	100	100	100	100	150	150	150
SR 1736 (S NC 214)	----	-----	250	350	400	500	600	700
SR 1738*	----	100	100	100	100	100	150	150
SR 1739 (0.2 mi W SR 1740)*	----	-----	150	200	200	250	250	300
SR 1739 (0.2 mi E SR 1735)*	----	100	100	100	100	100	150	150
SR 1740 (N NC 214)	900	1,150	1,400	1,750	2,150	2,600	3,200	3,950

* These values were found using the compound interest equation, $F = P(1 + i)^n$.

US 74-76, NC 214, and SR 1740 are thoroughfares that were rerouted after 1985; thus, any ADT counts taken before their changes in location were excluded from this analysis.

TABLE 3

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH
YEARLY ATR SUMMARY

STA 000034 US-74-76 .1 MI. E.OF US-701B ALL LANES COLUMBUS CO.

MONTH	ADT	AVG WKDAY	FACTOR	AVG SAT	AVG SUN	FACTOR TO ADJ. EACH WEEKDAY TO THE AVG. WEEKDAY MONDAY	TUESDAY	WEDSDAY	THRSDAY	FRIDAY	FACTOR TO ADJ. SHORT COUNT TO 24 HR 6AM-2PM	2PM-10PM	6AM-10PM
JAN													
FEB													
MAR													
APR													
MAY	8397	8397	.88	7678	9118	.98	1.13	1.18	1.06	.69	2.33	2.18	1.12
JUN	8221	8226	.90	7878	8545	1.06	1.13	1.03	1.00	.85	2.26	2.24	1.12
JUL	8330	8215	.90	8674	8561	1.08	1.13	1.06	1.00	.83	2.30	2.20	1.12
AUG	8081	8033	.92	7965	8437	1.06	1.12	1.10	1.00	.82	2.30	2.18	1.12
SEP	7621	8036	.92	6443	6727	.93	1.06	1.10	1.07	.86	2.27	2.21	1.12
OCT	7550	7619	.98	6350	8410	1.08	1.06	1.03	1.00	.82	2.24	2.20	1.11
NOV	7246	7330	1.01	6195	7882	1.22	1.27	.86	.97	.90	2.24	2.21	1.11
DEC	7584	8258	.90	5804	5998	.98	1.01	.94	1.06	.99	2.20	2.23	1.11
YEAR	7470	7971		7211	8106								

25th Highest Hour Volume	857	25th HHV % to Avg. Daily Traffic	11.5
30th Highest Hour Volume	828	30th HHV % to Avg. Daily Traffic	11.1
40th Highest Hour Volume	798	40th HHV % to Avg. Daily Traffic	10.7
50th Highest Hour Volume	764	50th HHV % to Avg. Daily Traffic	10.2

ADT Trends for 1984-1994

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ADT	4660	5030	5430	5950	6310	6320	6590	6770	7040	7140	7470
% Change	+8.2	+7.4	+8.0	+9.6	+5.7	+0.5	+4.3	+2.7	+4.0	+1.4	+4.6

Table 2 (Continued)
LAKE WACCAMAW PLANNING BOUNDARY AVERAGE DAILY TRAFFIC (ADT) VALUES
Major and Minor Thoroughfares

Route	1985	1990	1995	2000*	2005*	2010*	2015*	2020*
SR 1757 (Lake Shore Dr) E 1900	----	-----	1,000	1,000	1,050	1,100	1,100	1,150
SR 1757 (LS Dr)E of Lakeview Dr	----	-----	850	850	900	900	950	950
SR 1757 (LS Dr) E of Columbia	----	-----	900	900	950	950	1,000	1,050
SR 1757 (LS Dr) E of Pecan Ln	----	-----	800	800	850	850	900	900
SR 1757 (LS Dr) E of Birch St	----	-----	500	500	500	550	550	550
SR 1757 (Bartram/Jefferson Rd)**	500	2,300	500	550	600	650	650	700
SR 1900(Flemington Dr)0.1 mi NC 214	----	-----	1,750	1,850	2,000	2,050	2,150	2,250
SR 1900(Flem. Dr)0.05 mi S Nancy	----	-----	1,550	1,650	1,750	1,850	1,900	2,000
SR 1900(Flem. Dr)125 ft S McCray	----	-----	2,000	2,150	2,250	2,350	2,450	2,600
SR 1900(Canal Cove Rd)0.4miW 1757	----	-----	950	1,000	1,050	1,150	1,200	1,250
SR 1900(CC Rd) 1.5 mi W SR 1757	----	-----	750	800	850	900	950	1,000
SR 1900(CC Rd) 0.4 mi S SR 1957	----	-----	450	500	500	550	550	600
SR 1901 (N SR 1902)	900	1,000	1,000	1,100	1,150	1,200	1,300	1,350
SR 1901 (S SR 1902)	400	450	500	550	600	600	650	700
SR 1902 (0.4 S SR 1736)	----	200	250	300	350	450	600	750
SR 1947	400	450	500	500	550	550	600	600
SR 1957	500	550	450	500	500	550	550	600
SR 1967	----	-----	750	800	850	900	950	1,000

* These values were found using the compound interest equation, $F = P(1 + i)^n$.

US 74-76, NC 214, and SR 1740 are thoroughfares that were rerouted after 1985; thus, any ADT counts taken before their changes in location were excluded from this analysis.

** This route was a part of NC 214 at one time, which explains the large variation in ADT between 1985 and 1995.

US 74-76 as a comparison for all the roads within Columbus County. To obtain the June ADT, divide the Year ADT by the factor 0.90 (information: 1994 Highway Traffic Statistics, NC Department of Transportation, Statewide Planning Branch).

Traffic Accidents

Traffic accident analysis is essential in the development of a thoroughfare plan. The source of traffic accidents can be analyzed using three general categories:

(1) the physical environment,
(2) the driver, and
(3) the physical attributes of the vehicle itself.

The physical environment includes such things as road condition, weather, road obstructions, and traffic conditions. The driver influences the occurrence of traffic accidents through his mental alertness, distractions in the car, the ability to handle the vehicle, and reaction time. The physical attributes of the vehicle include the condition of the brakes and tires, vehicle responsiveness, size of the vehicle, and how well the windshield wipers and defrosters work. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.

Accident data for November 1992 through October 1994 was studied as part of the development of this report. Request for accident data was made at locations having one or more accidents. Seventeen accidents were found within the planning boundary. Five of these accidents occurred on a wet road surface; one occurred at night. Table 4 shows the type of accidents that occurred within the planning boundary and their locations.

Table 4

Type of Accidents and Their Locations

Ran-off-road: 4
- US 74-76/SR 1740
- NC 214/SR 1735
- SR 1901/SR 1957
- NC 214/Church Street

Sideswipe: 5
- US 74-76/SR 1735
- NC 214/SR 1757
- NC 214/SR 1740
- NC 214/Wananish Avenue
- SR 1736/SR 1901

Angle: 0

Rear-End: 3
- NC 214/SR 1735
- NC 214/SR 1757

Other: 2 (overturn, no collision)
- NC 214/SR 1757
- SR 1900/SR 1957

Left-turn-cross-traffic: 2
- NC 214/SR 1900
- NC 214/James Avenue

Left-turn-same-road: 1
- NC 214/SR 1740

Capacity Analysis

The adequacy of a street system can be found by comparing the traffic volumes with the traffic mobility of the streets. The ability of traffic to move on a street freely, safely, and efficiently with a minimum delay is controlled principally by the spacing of certain regulatory and warning signs or traffic signals used. Thus, traffic engineering techniques can increase traffic movement on a street (e.g., restricting parking and turning movements, using proper sign and signal devices).

Capacity is defined as the maximum traffic amount that can be accommodated by a given facility under prevailing roadway and traffic conditions. The traffic volume relationship to the roadway capacity will determine the *level of service* being provided. Six levels of service have been selected to identify the traffic conditions existing under various speed and volume road conditions.

The six levels of service are illustrated in Figure 5, and they are defined in the following paragraphs. The definitions are general and conceptual in nature. The 1994 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

1. **Level-of-service A** describes primarily free-flow operations at average travel speeds existing about 90% of the free-flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.
2. **Level-of-service B** represents reasonable unimpeded operations at average travel speeds usually about 70% of the free-flow speed for the arterial class. The ability to maneuver within the traffic stream is slightly restricted stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.
3. **Level-of-service C** represents stable operations. However, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B. Longer queues and/or adverse signal coordinations may contribute to lower average travel speeds of about 50% of the average free-flow speed for the arterial class. Motorists will experience an appreciable tension while driving.
4. **Level-of-service D** borders on a range on which small increases in flow may cause substantial increases in approach delay and hence, decreases in arterial speed. These delays may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these. Average travel speeds are about 40% of the free-flow speed.

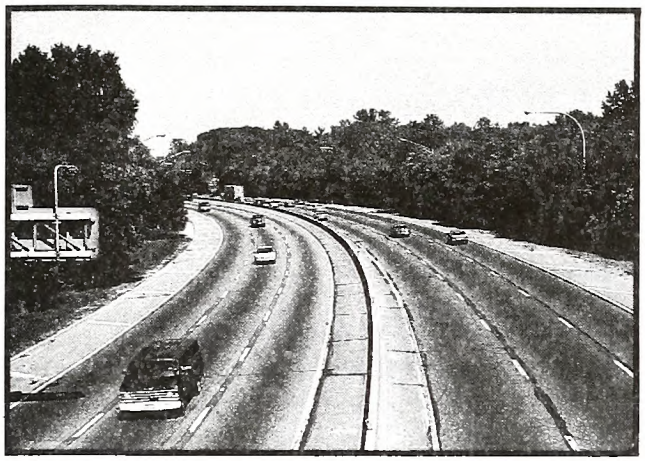
5. **Level-of-service E** is characterized by significant approach delays and average travel speeds 1/3 of the free-flow speed or lower. Such operations are caused by a combination of adverse progression, high signal density, extensive queuing at critical intersections, and inappropriate signal timing.
6. **Level-of-service F** characterizes arterial flow at extremely low speeds which are below 1/3 the free-flow speed. Intersection congestion is likely at critical signalized locations, resulting in high approach delays. Adverse progression is frequently a contributor to this condition.

The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing and new facilities in the design year of 2020. LOS D is considered the "practical capacity" of a facility, or that at which the public begins to express dissatisfaction.

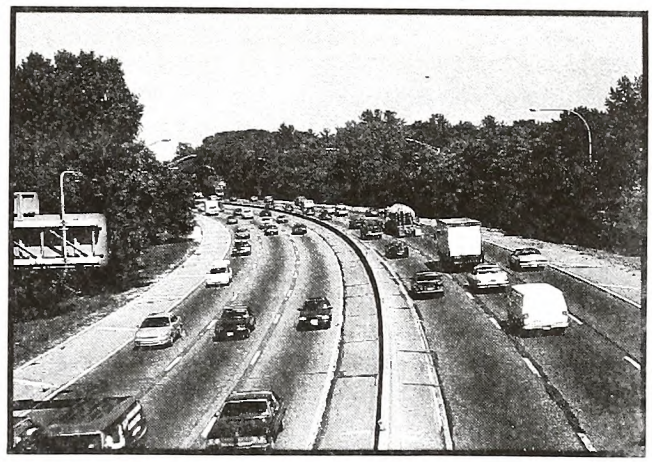
There are no severe capacity problems in the Lake Waccamaw area through the 25 year planning period. The most notable congested areas are at the north perimeter of the lake (along Canal Cove Road/Lake Shore Road) during summer holidays and weekends; this facility deals with pedestrians, bicycles, and autos during these times of the year. This road will not experience capacity problems but mostly maintenance problems caused by plugged drainage pipes and overflow areas around bridges. Yearly maintenance is significant to keep the lake road free of water and debris.

No other facilities in the area are expected to acquire congestion problems. However, it is recommended that the facilities with a width less than 24 feet be widened by the Town to allow for 12-foot lanes and two-way traffic.

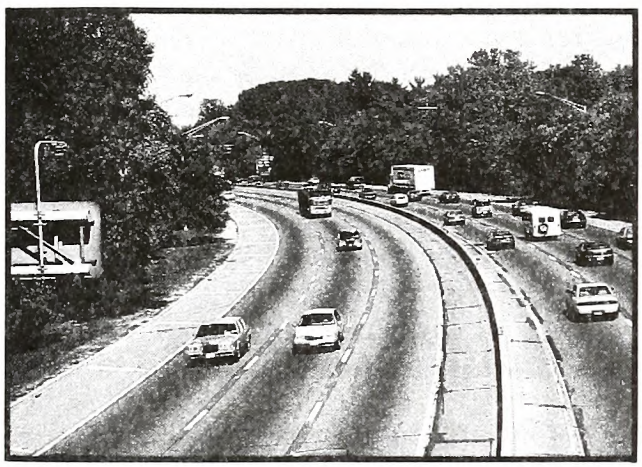
Source: 1994 Highway Capacity Manual



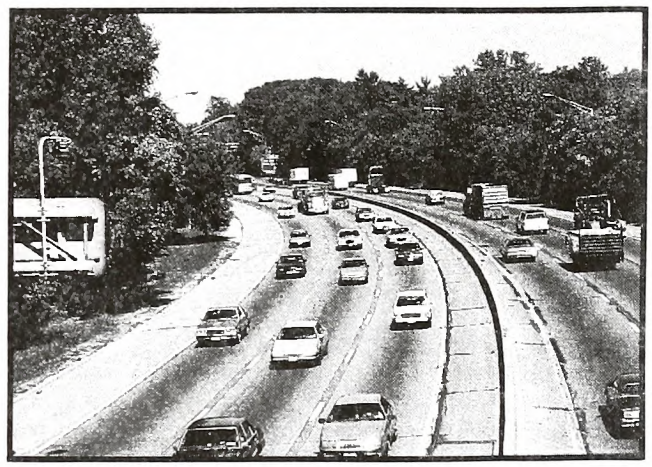
LOS A.



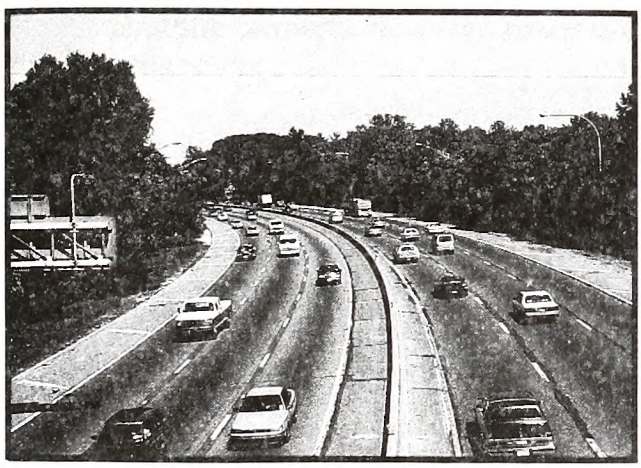
LOS D.



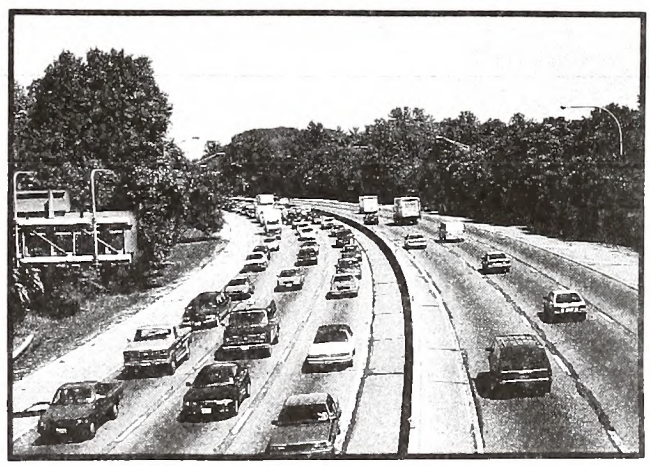
LOS B.



LOS E.



LOS C.



LOS F.

Figure 5

LEVELS OF SERVICE

Chapter 5

THOROUGHFARE PLANNING PRINCIPLES

The primary mission of thoroughfare planning is to assure that the road system will be progressively developed to serve future travel desires. Therefore, provisions are made for street and highway improvements so that when the need arises, feasible opportunities to make improvements exist.

Benefits of Thoroughfare Planning

The two major benefits derived from thoroughfare planning are: (1) the design of each road or highway to perform a specific function and provide a specific level of service, and (2) the reporting of future improvements to local officials for their possible incorporation into planning and policy decisions. Roads performing a specific function allows for savings in right-of-way, construction, and maintenance costs. Providing a specific level of service for roads allows for protection of residential neighborhoods and encouragement of stability in travel and land use patterns. Informing local officials of the thoroughfare plan:
(1) permits developers to design subdivisions in a non-conflicting manner,
(2) directs school and park officials to better locations of their facilities, and
(3) minimizes the damage to property values and community appearance sometimes associated with roadway improvements.

Thoroughfare Classification Systems

Streets give traffic service and land access to the public. The fact that streets combine these two functions together creates conflict due to the incompatibility of these functions. The conflict is not serious if both traffic and land service demands are low. High demands and uncontrolled, intensely developed abutting property, however, create intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets, permitting travel from origins to destinations with directness, ease and safety. Different streets in this system are designed and are essential to perform specific functions, thus minimizing the traffic and land service conflict.

Urban Classification

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets.

> Major Thoroughfares are the primary traffic arteries of the urban area providing for traffic movements within, around, and through the area.
> Minor Thoroughfares are designed to collect traffic from the local access streets and carry it to the major thoroughfare system.
> Local Access Streets provide access to abutting property. Local streets may be further classified as either residential, commercial and/or industrial depending upon the type of land use that they serve.

Idealized Major Thoroughfare System

The coordinated system of major thoroughfares that is most adaptable to the desired lines of travel within an urban area and that is reflected in most urban area thoroughfare plans is the radial-loop system. The radial-loop system includes radials, crosstowns, loops, and bypasses.

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of crosstown streets that form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets can carry heavy volumes of traffic; their major function is to help relieve central areas. Depending on the size of the urban area, more than one loop street may be needed. If this is the case, the loop streets are generally spaced 1/2-mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic that has no desire to be in the city. Designed at through-highway standards, access to the bypasses are restricted. Some bypasses with low volumes can function as part of an urban loop. Bypasses are created to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Objectives of Thoroughfare Planning

Thoroughfare planning is the process public officials use to assure the development of the most approapriate street system to meet the existing and future travel desires within the urban area. The primary aim of the thoroughfare plan is to guide the development of the street system in a manner consistent with changing traffic demands. Through proper planning for street development, costly errors and needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and help eliminate unnecessary improvements. By developing the street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimium amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present & future population and commercial & industrial enterprises affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

---To provide for the development of an adequate major street system as land development occurs;
---To reduce travel and transportation costs;
---To reduce the cost of major street improvements to the public through the coordination of street system with private action;
---To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;
---To minimize disruption and displacement of people and businesses through long range planning for major street improvements;
---To reduce environmental impacts, such as air pollution, resulting from transportation; and
---To increase travel safety.

These objectives are achieved through improving both thoroughfare operational efficiency and improving system efficiency by system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the ability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is the maximum number of vehicles that can pass a point on a roadway during a given period under current roadway and traffic conditions. Capacity is affected by the physical roadway features, traffic nature, and weather.

Physical ways to improve vehicular capacity include:

> Street Widening: widening a street from two to four travel lanes at least doubles the capacity by providing additional maneuverabliity for traffic.
> Intersection Improvements: the increase of the turning radii, the addition of exclusive turn lanes, and the channelization of movements improve the capacity of an existing intersection.
> Improving vertical and horizontal alignment: this reduces the congestion caused by slow moving vehicles.
> Eliminating roadside obstacles: this reduces side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

> Control of access: a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.
> Parking removal: this increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.
> One-Way operation: the street capacity can sometimes be increased 20-50% (depending upon turning movements and street width), by initiating one-way traffic operations. One-way streets improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.
> Reversible Lanes: may be used to increase street capacity in situations where heavy directional flows occur during peak periods.
> Signal phasing and coordination: uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

Carpools: use of carpools can reduce the number of vehicles on the roadway and raise the people-carrying capability of the street system.
Alternate mode: the use of alternate modes (e.g., transit, bicycles) of travel should be encouraged.
Work hours: industries, businesses and institutions staggering work hours or creating variable work hours for employees will reduce travel demand in peak periods and spread peak travel over a longer period.
Land use: a more travel-efficient land use development or redevelopment should be encouraged.

System Efficiency

Another means of altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, function classification, and idealized major thoroughfare system are some tools available to the transportation planner to develop a thoroughfare plan. In truth, thoroughfare planning is done for existing urban areas and curbed by existing land use & street patterns, existing public attitudes & goals, and current expectations of future land use. Compromises must be made because of these and other factors that affect major street locations.

Throughout the thoroughfare planning process, certain basic principles must be followed as closely as possible from a practical viewpoint. These principles are:

—The plan should be derived from a thorough study of today's travel, its features, and any contributing, limiting, or modifiying factors.
—Traffic demands must be sufficient to the kind and development of each major street. The thoroughfare plan should allow for a large portion of major traffic movements on a few streets.
—The plan should adapt and cater to the area land development plan.
—Urban development beyond the current planning period must be considered. In outlying or sparsely developed areas with development potential, thoroughfares must be denoted on a long-range planning basis to protect rights-of-way for future route development.
—While being consistent with the above principles and realistic with travel trends, the plan must be economically feasible.

IDEALIZED THOROUGHFARE PLAN

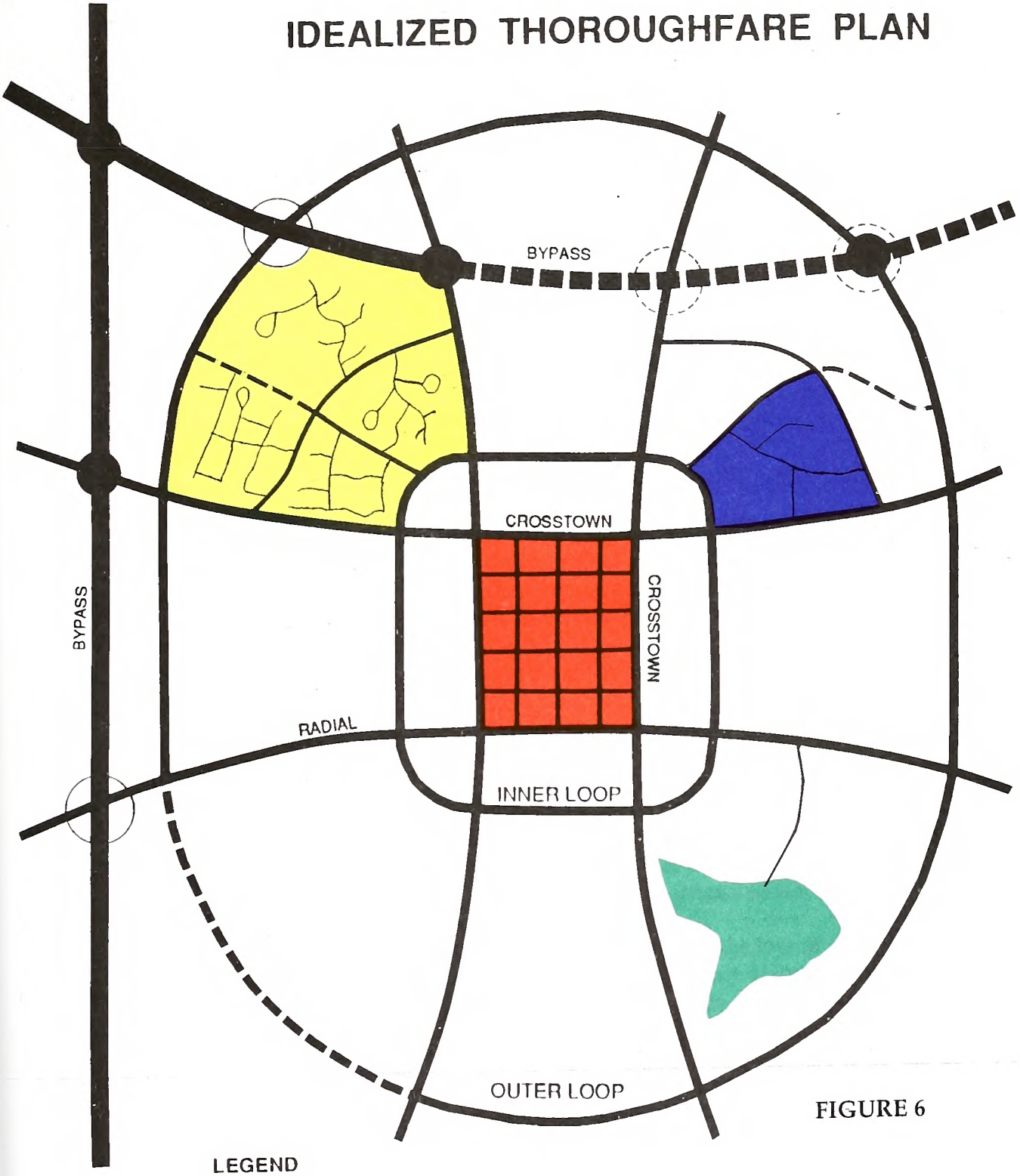


FIGURE 6

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE FREEWAY		
MAJOR OTHER		
MINOR THOROUGHFARE		
LOCAL ROAD		
INTERCHANGE		
GRADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

Chapter 6

IMPLEMENTATION OF THE THOROUGHFARE PLAN

Implementation is an essential aspect of the transportation plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the Town of Lake Waccamaw to assist in the implementation of the thoroughfare plan. They are listed below.

State-Municipal Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina states the development of a thoroughfare plan may bring adoption of the plan by the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the municipality and Department of Transportation shall reach agreement on the responsibilities for existing and proposed thoroughfares included in the plan. State-maintained facilities will be constructed and maintained by the Division of Highways; municipal-maintained facilities will be constructed and maintained by the municipality.

Mutual plan adoption will lead to the Department of Transportation initiating negotiations to find which of the existing and proposed thoroughfares will be a Department or a municipal responsibility. The Chapter of the General Statutes listed above provides guidance in the delineation of responsibilities.

To neglect the implementation process is a three-fold loss: the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly, the loss of the benefits to accrue from an improved transportation system.

The Town of Lake Waccamaw and the North Carolina Department of Transportation (NCDOT) have mutually adopted the thoroughfare plan shown in Figure 3. The mutually approved plan may now serve as a guide for the Department of Transportation in the development of the road and highway system for the Town. The approval of the plan by the Town also enables standard road regulations and land use controls to be used effectively in the incorporation of this plan.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the Town Planning Commission a plan of any proposed subdivision. The regulations also require that these areas be constructed to certain standards. Through this process, it is possible to require subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become part of the thoroughfare plan. The adequate construction of subdivision streets reduces maintenance costs and simplifies the transfer of streets to the State Highway System. Projects in Lake Waccamaw that could be implemented or protected by subdivision ordinances are Top Tobacco Road Extension, Cypress Road Extension, Schulken Street Extension, and White Oak Street Extension. Appendix C outlines the recommended subdivision design standards as they pertain to road construction.

Zoning Controls

Zoning is probably the single most commonly used legal device available for implementing a community's land-use plan. To paraphrase the US Department of Commerce 1924 Standard Zoning Enabling Act, on which most present-day legislation is based, zoning may be defined as the division of a municipality (or other governmental unit) into districts, and the regulation within the districts of:

---the height and bulk of buildings and other structures,
---the area of a lot which may be occupied and the size of required open spaces,
---the density of population, and
---the use of buildings and land for trade, industry, residence, or other purposes.

The distinguishing characteristic of a zoning ordinance from most other regulations is that it differs from district to district, rather than being uniform throughout a city. Thus, a given area might be restricted to single-family residential development with minimum lot size requirements and setback provisions appropriated for expansion. In other areas, commercial or industrial development might be permitted, and regulations would be enacted to control such expansion. Building code provisions or sanitary regulations, on the other hand, normally apply to all buildings in a certain category regardless of where they may be situated within a city.

The zoning ordinance does not regulate the design of streets, utility installation, the reservation or dedication of parks, street rights-of-way, school sites, and related matters. These are controlled by subdivision regulations or possibly by use of an official map (a document adopted by the community legislative body

denoting and preserving the location of proposed streets against encroachment). The zoning ordinance should, however, be carefully coordinated with these and other control devices.

Land Use Controls

Land use regulations are required in that they regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by warranting off-street parking and sufficient setbacks to provide for adequate sight distances.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the NCDOT District Engineer having authority over the planning area and the NCDOT Traffic Engineering Branch. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff of the NCDOT Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit. If done at an early stage, it is often possible to significantly improve the accessibility of the growth area while preserving the integrity of the thoroughfare plan.

Funding Sources

Capital Improvements Program (CIP)

A Capital Improvement Program for transportation is a long-range plan for spending money on street improvements, acquisition of rights-of-way and other improvements within the bounds of projected revenues. Municipal funds should be available for construction of street improvements that are a municipal responsibility, right-of-way cost sharing on facilities designated a Division of Highways responsibility, and advance purchase of right-of-way where such action is warranted.

Historically, cities and towns have depended a great deal on Federal and/or State funding to solve their transportation challenges. Chapter 136, Article 3A, of the Road and Highway Laws of North Carolina clearly outlines the responsibilities and obligations of NC Highway Bill 1211, passed in 1988, limits the role of municipalities to specific limits in right-of-way cost sharing. Set-back regulations, right-of-way cost dedications and resrevations play major role in the ultimate cost of many facilities. In few cases will the municipality be able to enjoy the benefits of highway improvement without some form of investment.

Transportation Improvement Program (TIP)

NCDOT's Transportation Improvment Program is a document listing all major construction projects NCDOT plans for the next seven years. Similar to local CIP projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programmed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request project to be included in the TIP. A Board of Transportation (NCBOT) member reviews all of the project requests in a particular area of the state. Based on the technical feasibility, need, and available funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement projects, highway safety projects, public transit projects, railroad projects, and bicycle projects.

Industrial Access Funds

If an industry wishes to develop property that does not have access to a state-maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban Funds are annual discretionary funds given to municipalities with qualifying projects. The maximum amount is $300,000 per year per project. A town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate NCBOT member and NCDOT Division Engineer.

The North Carolina Highway Trust Fund Law

The Highway Trust Fund Law was established in 1989 as a 13.5-year plan with four major goals for North Carolina roads and highways. These goals were:

—to complete the remaining 2768 km (1716 mi) of four-lane construction on the 5800 km (3600 mi) North Carolina Intrastate System.

—to construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.

---to supplement the secondary roads appropriation in order to pave, by 1999, 16,100 km (10,000 mi) of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.

---to supplement the Powell Bill Program.

The Powell Bill (General Statutes 136-41.1 through 136-41.3) allocates funds to qualified incorporated cities and towns for the maintenance, construction, and reconstruction of local streets that are the responsibility of the municipalities. The 1994 Powell Bill Funds allotted to Lake Waccamaw were $25,133.

In this planning period, Lake Waccamaw should look forward to the paving of most, if not all, of its unpaved roads on the state-maintained system within the planning boundary.

For more information on the Highway Trust Fund Law, contact the Program Development Branch of the NCDOT.

Table 5 provides a breakdown of the projects recommended in the Lake Waccamaw Thoroughfare Plan and the corresponding method best suited for the implementation of the given project. This table is shown on the following pages.

Table 5

PROCEDURES AND PROGRAMS RECOMMENDED FOR
IMPLEMENTATION OF PROJECTS
State Construction

Route	Rural Primary System	Urban System	Bridge Replac.	Secondary Roads
NC 214 Widening	X			
NC 214/SR 1735/SR 1900 Inters. Impr.	X			X
SR 1757 Widening				
SR 1900 (Canal Cove Rd) Widen. & Recnstrction.				X
Top Tobacco Rd Ext.				
Cypress Rd Ext.				
White Oak Ext.				
Schulken St Ext.				
Mt. Zion St Ext.				
Powell St Ext.				
Dixon St Ext.				

Table 5 (Continued)

PROCEDURES AND PROGRAMS RECOMMENDED FOR
IMPLEMENTATION OF PROJECTS
City Programs and Ordinances

Route	Constr.	Redvlp.	Block Grants	Bonds	Subd. Ordns.	Zoning Ordns.
NC 214 Widening						
NC 214/SR 1735/1900 Inters. Impr.						
SR 1757 Widening						
SR 1900 (Canal Cove Rd) Widening and Reconstruction	X					
Top Tobac. Rd Ext.	X			X	X	X
Cypress Rd Ext.	X			X	X	X
White Oak Ext.	X			X	X	X
Schulken St Ext.	X			X	X	X
Mt. Zion St Ext.	X			X	X	X
Powell St Ext.	X			X	X	X
Dixon St Ext.	X			X	X	X

Chapter 7

CONSTRUCTION IMPROVEMENTS AND COST ESTIMATES

The priorities placed on construction projects will vary depending on what criteria are considered and what weight is attached to the various criteria. A majority of the time, improvements to the major thoroughfare system and major traffic routes are more important than minor thoroughfares with the lower traffic volumes. To be placed into the NC TIP, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment.

The following measures were used to estimate the benefits that would be derived from each project: road user cost savings, the potential for increased economic development resulting from the improvement, and the positive and negative environmental impacts. The first measure is an estimate of actual dollar savings, while the others are estimates of the probability of the resulting change. These measures are described below.

Road user benefits should result from any roadway improvement (i.e., road widenings, new road construction). These benefits are achieved through reductions in transportation costs: vehicle operating, travel time, and accident costs. The total dollar savings over the design period (20-25 years) determines the benefits using such data as project length, base and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The economic development impact of a project is shown as the probability to stimulate development in an area by reducing transportation costs and providing access to productive land. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land growth potential. The probability rates the impact based on a scale from 0 (no impact) to 1.00 (excellent impact):

Subjective Evaluation	Success or Impact Probability
Excellent, highest	1.00
Very good, very substantial	0.75
Good, substantial, considerable	0.50
Fair, some	0.25
Poor, none	0.00

Estimation of environmental impacts on a project is based on the physical, social and/or cultural, and economic considerations. The following lists the types of environmental impacts:

Physical Environment	Social and Cultural Environment	Economic Environment
Air quality	Housing/ Neighborhoods	Businesses
Water Resources	Noise	Employment
Soils and Geology	Educational Facilities	Economic Development
Wildlife	Churches	Public Utilities
Vegetation	Parks and Recreational Facilties	Transportation Costs
	Public Health and Safety	Capital Costs
	National Defense	Operation and Maintenance Costs
	Aesthetics	
	Historic Sites and Landmarks	

Many of these impacts have been considered in the evaluation of the projects with respect to user benefits , cost & economic development potential. However, twelve of these environmental impacts listed above are not generally accounted for in the evaluation: air quality, water resources, soils and geology, wildlife, vegetation, neighborhoods, noise, educational facilities, churches, parks and recreational facilities, historic sites and landmarks, and public health and safety. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project.

The costs estimated in this report are based on the average statewide construction costs for similar project types. Table 6 evaluates the major proposed projects in the planning area with respect to user benefits, estimated costs, probability of economic development, and environmental impacts.

Many considerations go into the evolution of a project from initial idea to construction. Political, social, environmental, and economic considerations have varying amounts of influence at different points in time. For this reason, the adoption of a thoroughfare plan does not explicitly include priorities. However, prioities based on the factors already mentioned have been provided to help both the state and the municipality in their efforts to implement the improvements recommended in this report. Table 6 also ranks the major projects in three priority groups:

Project Priorities	Description
Priority 1	Projects aimed at alleviating existing traffic congestion problems (e.g., widening, new road construction)
Priority 2	Projects to improve the flow of traffic through and around Lake Waccamaw; projects to provide quick and convenient access to various parts of the town
Priority 3	All other projects in thoroughfare plan that have not yet been mentioned

Due to its completion, US 74-76 has relieved any congestion problems that occurred within the planning boundary during the last ten years. None of the proposed projects would be grouped under Priority 1; however, any widenings recommended in the thoroughfare plan would be grouped under Priority 1. All of the proposed projects in the thoroughfare plan (e.g., White Oak Extension) would be listed as a part of Priority Group 2; each of the extensions were recommended to improve the flow of traffic through the town and provide access to certain areas within the town. No other projects were recommended to be grouped under Priority 3.

Table 6
CONSTRUCTION PRIORITIES FOR
LAKE WACCAMAW THOROUGHFARE PLAN

Priority Groups	Length (km)	Existing Cross Section	Proposed Cross Section	Costs (x 1,000) Const	R/W	Total	Probable Impacts Econ Develop	Environmental +	-
Priority Group 1:									
SR 1735	4.03	6-m width 2-lane road	7-m width 2-lane road	1,461	18	1,479	0.20	0.50	0.50
SR 1736	2.71	4-m width 2-lane road	6-m width 2-lane road	1,179	18	1,197	0.20	0.60	0.40
SR 1739	2.74	5-m width 2-lane road	6-m width 2-lane road	993	12	1,005	0.20	0.60	0.40
SR 1757	5.20	6-m width 2-lane road	7-m width 2-lane road	1,885	60	1,945	0.20	0.50	0.50
SR 1900	5.25	6-m width 2-lane road	7-m width 2-lane road	1,912	75	1,987	0.20	0.50	0.50
SR 1942	0.16	5-m width 2-lane road	6-m width 2-lane road	46	2	48	0.20	0.60	0.40
SR 1947	4.42	6-m width 2-lane road	7-m width 2-lane road	1,603	60	1,663	0.20	0.60	0.40

Table 6 (continued)
CONSTRUCTION PRIORITIES FOR
LAKE WACCAMAW THOROUGHFARE PLAN

Priority Groups	Length (km)	Existing Cross Section	Proposed Cross Section	Costs (x 1,000) Const	R/W	Total	Probable Impacts Econ Develop	Environmental +	-
Priority Group 2:									
White Oak Extension	0.08	proposed	6-m width 2-lane road	75	6	83	0.40	0.50	0.50
Cypress Rd Extension	0.09	proposed	6-m width 2-lane road	85	2	87	0.40	0.50	0.50
Schulken Rd Extension	0.46	proposed	6-m width 2-lane road	434	11	445	0.40	0.50	0.50
Mt. Zion St Extension	0.18	proposed	6-m width 2-lane road	170	4	174	0.40	0.50	0.50
Powell St Extension	0.23	proposed	6-m width 2-lane road	217	5	222	0.40	0.50	0.50
Dixon St Extension	0.23	proposed	6-m width 2-lane road	217	5	222	0.40	0.50	0.50
Top Tobacco Rd Ext. (around wetland area)	1.47	proposed	6-m width 2-lane road	1,386	34	1,420	0.40	0.50	0.50
Priority Group 3:									
NONE									

Chapter 8

ENVIRONMENTAL CONCERNS

In the past few years, environmental considerations associated with highway construction have come to the forefront of the planning process. The National Environmental Policy Act dictates the necessary procedures regarding environmental impacts. Section 102 of this act requires the execution of an environmental impact statement (EIS) for road projects having a significant impact on the environment. Included in an EIS would be the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not detail the environmental concerns as much as an EIS would, preliminary research was done on several of these factors and is included below.

Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973 allows the US Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we can avoid or minimize these impacts.

The North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR) was the source for the name and type of each natural area, endangered species, or community that existed in Columbus County and Lake Waccamaw. Twenty-nine animals, sixty-seven plants, and twenty-three natural areas were identified as rare or significant in Columbus County. (Refer to Appendix D for definitions of the rarity or significance of a species or area.) Lake Waccamaw has seventeen rare animals, thirty-one rare plants, and thirteen significant natural areas or communities. The following list shows the federally protected species and areas located in the Lake Waccamaw planning boundary.

<u>Rare animals</u> (Scientific name (common name--description or location))

- Alligator mississippiensis (American alligator---in the drainage canal)
- Elassoma boehlkei (Carolina pygmy sunfish---in streams, canals)
- Etheostoma perlongum (Waccamaw darter---a freshwater fish)
- Fundulus waccamensis (Waccamaw killifish---a freshwater fish)
- Menidia extensa (Waccamaw silverside---a freshwater fish)
- Elliptio waccamawensis (Waccamaw spike---a freshwater mollusk)
- Toxolasma pullum (Savannah lilliput---a freshwater mollusk)
- Triodopsis soelneri (Cape Fear threetooth---a terrestrial mollusk)
- Procambarus leptodactylus (Pee Dee lotic crayfish--L.W. River Habitat)
- Corynorhinus rafinesquii (Rafinesque's big-eared bat--within CL L. W.)

Rare plants

Lachnocaulon beyrichianum (Southern bogbutton---a vascular plant)
Fimbristylis perpusilla (Harper's fimbry---a vascular plant existing in drawndown bars in the channel)
Ilex amelanchier (Sarvis holly)
Rhynchospora decurrens (Swamp forest beaksedge---a vascular grasslike plant with triangular, solid stems, three rows of narrow, pinted leaves, and minute flowers borne in spikelets (spike-shaped))

The following is a list of the federally protected species and areas (or those under consideration of being federally protected) located in Columbus County not located in the Lake Waccamaw planning boundary.

Rare animals

Acipenser brevirostrum (Shortnose sturgeon---fish)
Aimophila aestivalis (Bachman's sparrow)
Ammodramus henslwii (Henslow's sparrow)
Ophisaurus mimicus (Mimic glass lizard)
Picoides borealis (Red-cockaded woodpecker)

Rare plants

Amorpha georgiana var confusa (Savannah indigo-bush)
Dionaea muscipula (Venus flytrap)
Lysimachia asperulifoia (Rough-leaf loosestrife)
Macbridea caroliniana (Carolina bogmint)
Parnassia caroliniana (Carolina grass-of-parnassus)
Plantago sparsiflora (Pineland plantain)
Platanthera integra (Yellow fringeless orchid)
Solidago verna (Spring-flowering goldenrod)
Sporobolus teretifolius (Wireleaf dropseed)
Thalictrum cooleyi (Cooley's meadowrue)
Tofieldia glabra (Carolina asphodel)

Out of all these endangered plants and animals, the habitat of one animal may be affected by roads proposed to be built in this thoroughfare plan. This animal is Rafinesque's big-eared bat, found in an abandoned building in the town limits of Lake Waccamaw. Many of the state maintained roads in the planning area are recommended to be widened by 0.3049 m to 1.2195 m (1' to 4') on either side and/or paved. There are also three proposed routes within the town limits of Lake Waccamaw. Special care will be taken during the project planning stage of these projects to insure the protection of the area.

Wetlands

In general terms, wetlands are those areas where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by erosion. They are also critical to fish and wildlife populations. Wetlands provided an important habitat for about one third of the land and animal species that are federally listed as threatened or endangered.

In this study, the impacts to wetlands were determined using the National Wetlands Inventory Mapping, available from the U.S. Fish and Wildlife Service.

Wetlands impacts should be avoided or minimized to the greatest extent possible while preserving the integrity of the transportation plan.

The following is a list of the federally protected natural communities (or those under consideration of being federally protected) located in the Lake Waccamaw planning boundary.

<u>Endangered natural communities</u>

- Cypress-Gum Swamp (blackwater subtype)
- Coastal Plain Small Stream Swamp (blackwater subtype)
- Nonriverine Wet Hardwood Forest
- Nonriverine Swamp Forest
- Coastal Fringe Evergreen Forest
- Coastal Plain Levee Forest (blackwater subtype)
- Natural Lake Shoreline
- Pond Pine Woodland
- Coastal Fringe Sandhill
- Sand and Mud Bar

Recommendations and Comments

Any improvements or additions to the Lake Waccamaw thoroughfare system have been checked for infringements onto the surrounding environment. From the recommendations beginning on page 7, the following improvements/ additions will have little to no impact on the surrounding area:

US 74-76, SR 1738, SR 1901, SR 1902, SR 1961, SR 1962, SR 1963, SR 1964, SR 1965, SR 1969

The following improvements/additions may have some impact on their surrounding area (WCL LW = west city limits of Lake Waccamaw):

---NC 214, from WCL LW to SR 1735 (1.11 km (0.69 mi))
Widening 0.31 m (1 ft) on each side of road; watch for Cemetary and any abandoned buildings along this stretch due to endangered bat (Rafinesque's big-eared bat) possibly living there.

---SR 1736 & extension
Building new road, widening 0.92-1.52 m (3-5 ft) on each side and additions from the SR 1736 Extension to its cross streets (i.e., Dixon St); watch for any abandoned buildings along this stretch due to endangered bat possibly living there.

---SR 1739, from SR 1740 to 0.2 mi east of SR 1735 (2.42 km (1.50 mi))
Widening 1.22 m (4 ft) on either side; watch for endangered plant Flaxleaf Gerardia near SR 1739/SR 1740 intersection.

---SR 1740:
from Slap Swamp Bridge to SR 1739 (1.29 km (0.80 mi))
Widening 0.92 m (3 ft) on either side and rebuild the bridge; watch for endangered plant Flaxleaf Gerardia and the natural community of Coastal Plain Small Stream Swamp at the bridge.
from NCL LW to SR 1757 (2.26 km (1.40 mi))
Widening 0.61-0.92 m (2-3 ft) on either side and paving; watch for any abandoned buildings along this stretch due to endangered bat possibly living there.

---SR 1757, from SR 1900 to ECL LW (3.25 km (2.02 mi))
Widening 0.92 m (3 ft) on either side; watch for 5 endangered plants, 2 natural communities and the bat.

---SR 1900, from SR 1757 to SR 1901 (4.83 km (3.00 mi))
Widening 0.92 m (3 ft) on either side; watch for 6 endangered animals, 3 plants, and the Cove Swamp community in general.

---SR 1942, from SR 1757 to ECL LW (0.16 km (0.10 mi))
Widening 1.22 m (4 ft) on either side; watch for any abandoned buildings along this stretch due to endangered bat possibly living there.

Improvements/additions continued:

---SR 1947, from SR 1957 to Dead End (4.41 km (2.74 mi))

Widening 0.61 m (2 ft) on either side; watch for an endangered plant, 2 animals, 2 natural communities (Council Ridge and Green Swamp), and the Lake Waccamaw State Park.

---SR 1957, from WCL LW to SR 1900 (0.03 km (0.02 mi))

Widening 0.61 m (2 ft) on either side; watch for Cove Swamp and the bat.

---SR 1960, from SR 1957 to Dead End (0.48 km (0.30 mi))

Widening 0.61 m (2 ft) on either side; watch for Cove Swamp.

---SR 1967, from SR 1901 to Dead End (4.66 km (2.89 mi))

Widening 0.61 m (2 ft) on either side; watch for Bogue Swamp, including plants and animals in the swamp.

---Schulken Street Extension

Watch for any abandoned buildings along this stretch due to endangered bat possibly living there.

Appendix A

Lake Waccamaw Planning Area

Thoroughfare Plan Street Tabulation and Recommendations

LAKE WACCAMAW THOROUGHFARE PLAN

Facility and Section (in km)	Existing Cross Section Distance (km)	Roadway Width (m)	R/W (m)	Capacity	ADT Volumes 1994	2020	Recommended Cross Section Roadway Width (ult)	R/W (ult)
US 74-76								
4.35 km W SR 1735 to SR 1740	6.45	15	122	50000	9200	13000	ADQ	ADQ
SR 1740 to NC 214	2.66	15	122	50000	8900	13500	ADQ	ADQ
NC 214 to 2nd Friar Swp Brd	1.61	15	122	50000	7600	10500	ADQ	ADQ
NC 214								
0.06 km E SR 1734 to WCL LW	3.70	7	18	12000	N/A	N/A	7	ADQ
WCL LW to SR 1735	1.11	7	18	12000	2500	3800	7	ADQ
SR 1735 to Schulken St	0.81	7	18	12000	2800	4150	7	ADQ
Schulken St to ECL LW	1.84	7	18	12000	2900	4350	7	ADQ
SR 1735 to ECL LW	2.66	7	18	12000	N/A	3500	7	ADQ
ECL LW to US 74-76	1.61	7	18	12000	N/A	3600	7	ADQ
SR 1735								
0.06 N SR 1791 to 0.12 S SR 1739	1.45	6	18	11000	N/A	N/A	7	ADQ
0.12 S SR 1739 to US 74-76	2.58	6	N/A	9000	N/A	N/A	7	18
US 74-76 to NCL LW	0.42	7	18	12000	N/A	N/A	7	ADQ
NCL LW to NC 214	0.53	7	N/A	12000	2000	6200	7	18
SR 1736 and extension								
James Ave to SR 1735 (PROPOSED)	1.21	**********	**********	PROPOSED	**********	**********	6 (7)	18
SR 1735 to 0.19 W SR 1735	0.48	6	N/A	9000	N/A	N/A	6 (7)	18
0.19 W SR 1735 to WCL LW	0.77	4	N/A	9000	N/A	N/A	6 (7)	18
WCL LW to 1.1 W WCL LW	1.13	4	N/A	9000	90	200	6 (7)	18
1.1 W WCL LW to NC 214	0.81	4	N/A	9000	60	100	6 (7)	18
NC 214 to SR 1901	2.10	6	N/A	9000	N/A	1250	6 (7)	18
SR 1738								
SR 1735 to Dead End	0.81	6	N/A	9000	30	72	6 (7)	18

LAKE WACCAMAW THOROUGHFARE PLAN

Facility and Section	Existing Cross Section Distance (km)	Roadway Width (m)	R/W (m)	Capacity	ADT Volumes 1994	2020	Recommended Cross Section Roadway Width (ult)	R/W (ult)
SR 1739								
SR 1740 to 0.12 E SR 1735	2.42	5	N/A	9000	90	300	6 (7)	18
0.12 E SR 1735 to SR 1735	0.32	5	N/A	9000	80	100	6 (7)	18
SR 1740								
SLAP SWP BRIDGE to SR 1739	1.29	6	N/A	9000	N/A	N/A	6 (7)	18
SR 1739 to US 74-76	1.13	6	N/A	9000	N/A	N/A	6 (7)	18
US 74-76 to NCL LW	0.48	6	N/A	9000	N/A	N/A	6 (7)	18
NCL LW to NC 214	0.53	6	N/A	8500	N/A	3950	6 (7)	18
NC 214 to SR 1740 (Pecan Ln)	0.32	6	N/A	8000	N/A	N/A	6 (7)	18
SR 1740 (E. OAK ST) to ECL LW	0.60	6	N/A	9500	N/A	N/A	6 (7)	18
ECL LW to SR 1757	0.81	8	N/A	12000	N/A	N/A	ADQ	18
SR 1757								
SR 1900 to SR 1942	3.05	6	N/A	9000	N/A	N/A	7	18
SR 1942 to ECL LW	0.21	6	N/A	9000	N/A	N/A	7	18
ECL LW to NC 214	1.94	6	18	9000	570	800	7	ADQ
SR 1900								
NC 214 to Nancy St	0.31	17	N/A	13000	1750	2250	ADQ	31
Nancy St to SR 1757	0.41	6	N/A	9000	2000	2600	7	18
SR 1757 to 1.05 km W SR 1757	1.05	6	N/A	9000	950	1200	7	18
1.05 km W SR 1757 to SR 1957	2.74	6	N/A	9000	750	950	7	18
SR 1957 to SR 1901	1.05	6	N/A	9000	450	600	7	18
SR 1901								
SR 1736 TO SR 1957	1.29	6	N/A	9000	N/A	950	6 (7)	18
SR 1957 to SR 1900	2.29	6	N/A	9000	N/A	700	6 (7)	18
SR 1902								
SR 1901 to Planning Boundary	0.81	6	N/A	11000	N/A	950	ADQ	18

LAKE WACCAMAW THOROUGHFARE PLAN

Facility and Section	Existing Cross Section Distance (km)	Roadway Width (m)	R/W (m)	Capacity	ADT Volumes 1994	2020	Recommended Cross Section Roadway Width (ult)	R/W (ult)
SR 1942								
SR 1757 to ECL LW	0.16	5	N/A	8000	N/A	N/A	6 (7)	18
ECL LW to End of Paving	0.21	6	N/A	11000	N/A	N/A	ADQ	18
End of Paving to Dead End	0.27	6	N/A	11000	N/A	N/A	ADQ	18
SR 1947								
SR 1757 to ECL LW	0.11	6	N/A	11000	N/A	N/A	7	18
ECL LW to Dead End	4.31	6	N/A	11000	N/A	400	7	18
SR 1957								
SR 1901 to WCL LW	1.45	6	N/A	11000	N/A	500	ADQ	18
WCL LW to SR 1900	0.03	6	N/A	11000	N/A	N/A	ADQ	18
SR 1960								
SR 1957 to Dead End	0.48	6	18	11000	50	100	ADQ	ADQ
SR 1961								
SR 1957 to SR 1960	0.32	6	18	11000	60	170	ADQ	ADQ
SR 1962								
SR 1957 to Dead End	0.37	6	18	11000	70	100	ADQ	ADQ
SR 1963								
SR 1957 to SR 1964	0.29	6	18	11000	120	200	ADQ	ADQ
SR 1964								
SR 1963 to Dead End	0.16	6	18	11000	N/A	N/A	ADQ	ADQ
SR 1965								
SR 1963 to Dead End	0.16	6	18	11000	N/A	N/A	ADQ	ADQ
SR 1967								
SR 1901 to Dead End	4.66	6	18	11000	750	950	ADQ	ADQ
SR 1969								
SR 1957 to Dead End	0.19	6	18	11000	N/A	N/A	ADQ	ADQ

LAKE WACCAMAW THOROUGHFARE PLAN

Facility and Section	Existing Cross Section Distance (km)	Roadway Width (m)	R/W (m)	Capacity	ADT Volumes 1994	2020	Recommended Cross Section Roadway Width (ult)	R/W (ult)
White Oak St Extension (PROPOSED) Lakeview Ave to W End of White Oak St	0.08	**********	**********	PROPOSED	**********	**********	7	18
Cypress Road Extension (PROPOSED) Lakeview Ave to W End of Cypress Road	0.09	**********	**********	PROPOSED	**********	**********	7	18
Schulken Road Extension (PROPOSED) Church St to Top Tobacco Ext.	0.46	**********	**********	PROPOSED	**********	**********	7	18
Mt. Zion St Extension (PROPOSED) N End of Mt. Zion St to Top Tobacco Extension	0.18	**********	**********	PROPOSED	**********	**********	7	18
Powell St Extension (PROPOSED) N End of Powell St to Top Tobacco Extension	0.23	**********	**********	PROPOSED	**********	**********	7	18
Dixon St Extension (PROPOSED) N End of Dixon St to Top Tobacco Extension	0.23	**********	**********	PROPOSED	**********	**********	7	18

APPENDIX B

Typical Thoroughfare Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and LOS to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired LOS, and available right-of-way (R/W).

Typical cross sections recommendations are shown in Appendix A. These cross sections are typical for facilities on new location and where R/W constraints are not critical. For widening projects and urban projects with limited R/W, special cross sections should be developed to meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available R/W. The recommended typical cross sections for the thoroughfares are given in Appendix A along with other pertinent information.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate R/W should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed in Appendix A. Recommendations for "ultimate" cross sections are provided for

(1) thoroughfares which may require widening after the current planning period;
(2) thoroughfares which are borderline adequate and where accelerated traffic growth could render them deficient; and
(3) thoroughfares where an urban curb-and-gutter cross section may be locally desirable because of urban expansion or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related superelevation, and other considerations for thoroughfares are given in Appendix C. This Appendix C gives definitions and design standards recommended for inclusions in subdivision regulations.

Cross sections "A" and "L" is typical for controlled access freeways. The 14-m (46-foot) grassed median is the least desirable median width, but some variation could exist depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

Cross section "B", seven lane curb and gutter, should not be used for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as when widening from a five lane section and right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to median so that cross section "D" is the final cross section.

Cross section "C", five-lane curb and gutter, is typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "D", "E" and "M" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.9-m (16-ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed or placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only recommended when the above concerns are addressed.

Cross section "F" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 feet) is recommended with 9.1 m (30 feet) being desirable.

Typical cross section "G" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left-turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto *(existing but without legal means)* left-turn lanes.

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require **cross section "H"**. **Cross sections "I" and "J"** are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. **Cross section "I"** would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

Cross section "K" is used in rural areas or for staged construction of wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full R/W of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m (100 ft). In those cases, 21 m (70 ft) should be preserved, knowing that the full 30 m (100 ft) will be preserved by the use of building setbacks and future street line ordinances.

The curb-and-gutter urban cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum R/W line. This permits adequate setback for utility poles. If it is desired to move the sidewalk further away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional R/W must be provided to insure adequate setback for utility poles.

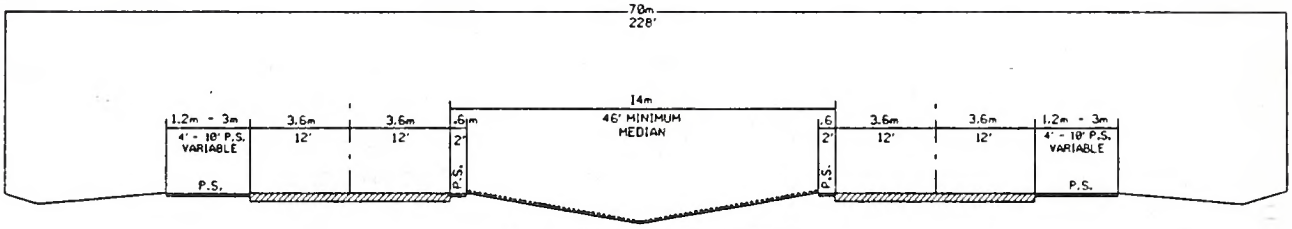
The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require additional R/W or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional R/W may be required to contain the bicycle facilities. The North Carolina Bicycle Facility and Program Handbook should be consulted for design standards for bicycle facilities. **Cross sections N, O, and P** are typically used to accommodate bicycle travel.

Figure 7

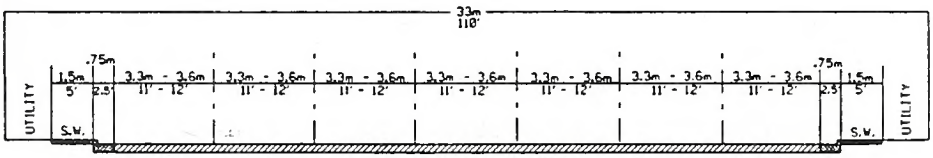
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



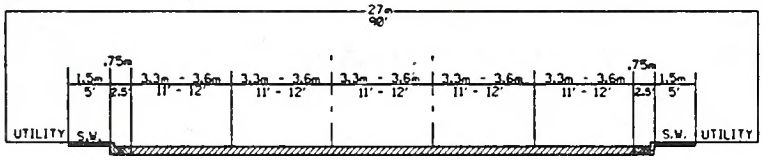
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



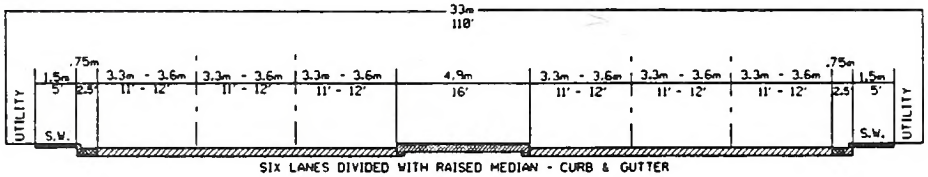
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

D.

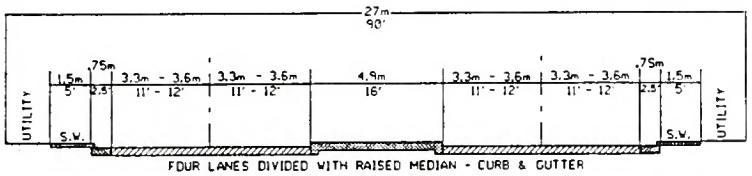


SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

Figure 7 (continued)

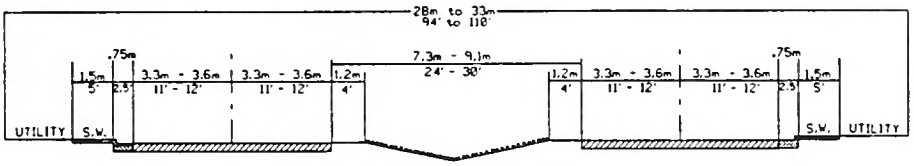
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



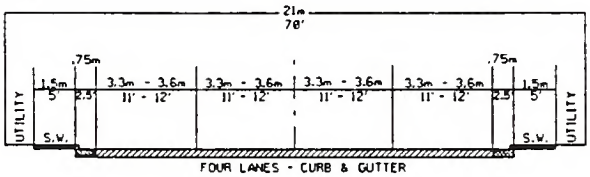
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



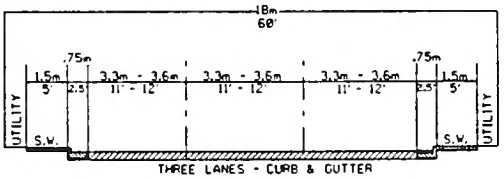
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



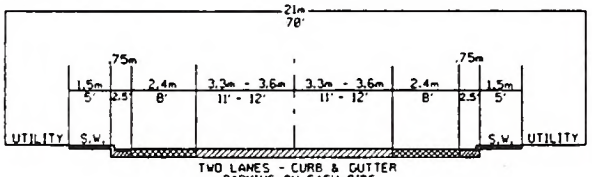
FOUR LANES - CURB & GUTTER

H.



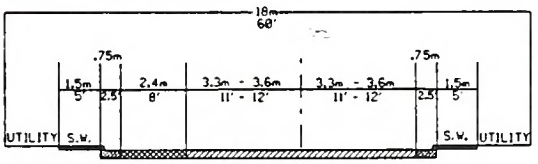
THREE LANES - CURB & GUTTER

I.



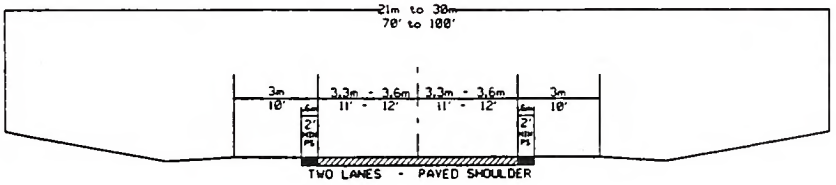
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

K.

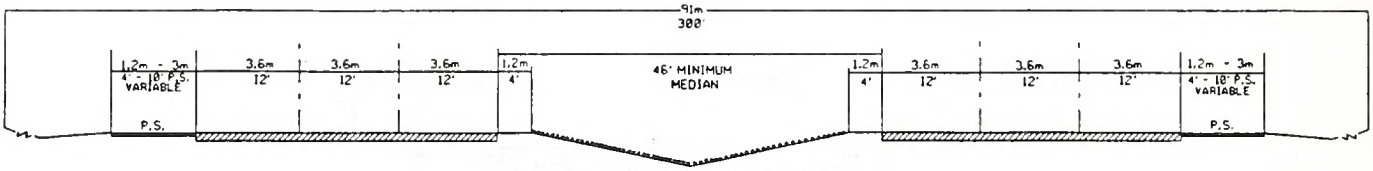


TWO LANES - PAVED SHOULDER

Figure 7 (continued)

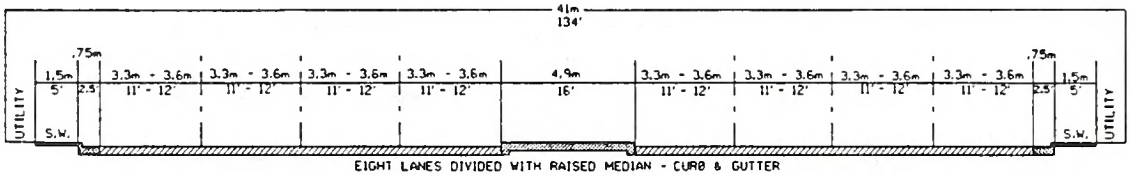
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

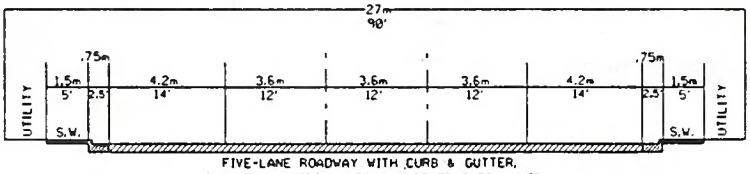
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

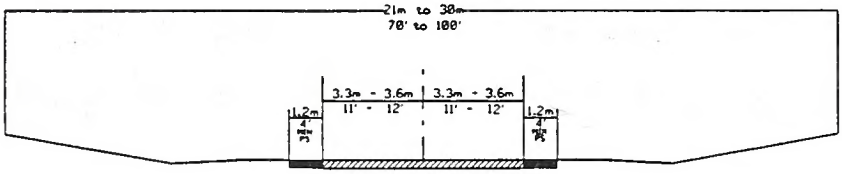
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



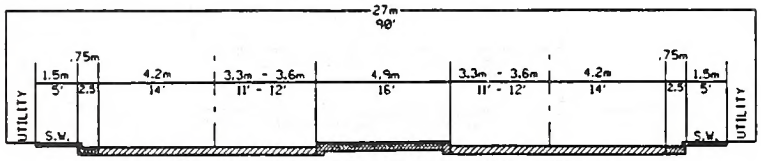
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

APPENDIX C

Recommended Subdivision Ordinances

Definitions

I. Streets and Roads

A. Rural Roads

1. Principal Arterial: A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.
2. Minor Arterial: A rural roadway joining cities and larger towns and providing intrastate and inter-county service at relatively high overall travel speeds with minimum interference to through movement.
3. Major Collector: A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.
4. Minor Collector: A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.
5. Local Road: A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares: Major thoroughfares consist of Interstate, Intrastate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.
2. Minor Thoroughfares: Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.
3. Local Street: A local street is any street not on a higher order urban system & serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway: Divided multilane highways designed to carry large volumes of traffic at higher speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property, with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major intersections. A parkway is for non-commercial traffic, with full or partial control of access.
2. Residential Collector Street: A local street which serves as a connector street between local residential streets and the thoroughfares system. Residential collector streets typically collects traffic from 100 to 400 dwelling units.
3. Local Residential Street: Cul-de-sacs, loop streets less than 760 m (2500 feet) in length, or streets less than 1.6 km (1.0 mi) in length that do not connect thoroughfares, serve major traffic generators, or collect traffic from more than 100 dwelling units.
4. Cul-de sac: A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.
5. Frontage Road: A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.
6. Alley: A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line: A line parallel to the street in front of which no structure shall be erected.

B. Easement: A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot: A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The work "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider: Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

B. Subdivision: All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street of change in existing streets; provided, however, that the following shall not be included within this definition not subject to these regulations:

(1) the combination or recombination of portions of previously platted lots where the toal number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein,

(2) the division of land into parcels greater than 4 hectares (10 acres) where no street R/W dedication is involved,

(3) the public acquisition, by purchase, of strips of land for the widening of opening of streets, and

(4) the division of a tract in single ownership whose entire area is no greater than 0.8 hectares (2 acres) into not more than 3 lots, where no street R/W dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication: A gift, by the owner, of his property to another party without any considerations being given for the transfer. The dedication is made in writing and is completed with an acceptance.

D. Reservation: Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the planning area shall be in accordance with the accepted policies of the North Carolina Department Of Transportation (NC DOT), Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street right-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the Town of Lake Waccamaw.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths: R/W widths shall not be less than the following and shall apply except in those cases where R/W requirements have been specifically set out in the Thoroughfare Plan.

1. Rural Roads	Minimum R/W (ft)	R/W (m)
Principle Arterial		
Freeways	350	105
Other	200	61
Minor Arterial	100	30
Major Collector	100	30
Minor Collector	80	24
Local Road	60*	18[1]

2. Urban Roads	Minimum R/W (ft)	R/W (m)
Major Thoroughfare not Freeway/Expressway	90	27
Minor Thoroughfare	70	21
Local Street	60	18[1]
Cul-de-Sac	Variable[2]	

[1] The desirable minimum R/W is 18 m (60 ft). If curb and gutter are provided, 15 m (50 ft) of R/W is adequate on local residential streets.

[2] The R/W dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to R/W should not be less than distance from edge of pavements to R/W on street approaching the turnaround.

The subdivider will only be required to dedicate a maximum of 30 m (100 ft) of R/W. In cases where over 30 m (100 ft) of R/W is desired, the subdivider will be required only to reserve the amount in excess of 30 m (100 ft). On all cases in which R/W is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisons provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width R/W (not less than 18 m (60 ft) in width) may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider, provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required R/W shall be dedicated.

B. Street Widths: Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential:
   Curb-and-gutter section: 7.9 m (26 ft), face to face of curb
   Shoulder section: 6.1 m (20 ft) to edge of pavement, 1.2 m (4 ft) for shoulders
2. Residential Collector:
   Curb-and-gutter section: 10.4 m (34 ft), face to face of curb
   Shoulder section: 6.1 m (20 ft) to edge of pavement, 1.8 m (6 ft) for shoulders

C. Geometric Characteristics: The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under R/W shall apply.

1. Design Speed: The design speed for a roadway should be a minimum of 8.1 kmh (5 mph) greater than the posted speed limit. The design speeds for subdivisions type streets shall be:

DESIGN SPEEDS TABLE A (METRIC)			
Facility Type	Design Speed km/h Desirable	Minimum Level	Minimum Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	100	80	60
Local roads including Residential Collectors and Local Residential (ADT Over 400)	80	80	60
URBAN			
Major Thoroughfares other than Freeway or Expressway	100	60	60
Minor Thoroughfares	100	50	50
Local Streets	50	50	30

DESIGN SPEEDS TABLE B (ENGLISH)			
Facility Type	Design Speed mph Desirable	Minimum Level	Minimum Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	60	50	40
Local roads including Residential Collectors and Local Residential (ADT Over 400)	50	* 50	* 40
URBAN			
Major Thoroughfares other than Freeway or Expressway	60	50	40
Minor Thoroughfares	40	30	30
Local Streets	30	**30	**20

* Based on ADT of 400-750. Where roads serve a limited area and small number of units, can reduce min design speed.

**Based on projected ADT of 50-250.
(Reference NCDOT Roadway Design Manual page 1-1B)

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE TABLE C (METRIC)				
Facility Type	Design Speed (km/h)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	30	7	10	12
	50	7	9	10
	65	7	8	10
	80	6	7	9
	100	5	6	8
	110	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	30	-	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	50	8	9	11
	65	7	8	10
	80	6	7	9
	100	5	6	8
Minor Thoroughfares*	30	9	12	14
	50	9	11	12
	65	9	10	12
	80	7	8	10
	100	6	7	9
	110	5	6	7
Local Streets*	30	-	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	-

* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.
(Reference NCDOT Roadway Metric Design Manual page 1-12 T-3)

MAXIMUM VERTICAL GRADE TABLE D (ENGLISH)				
Facility Type	Design Speed (mph)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	20	7	10	12
	30	7	9	10
	40	7	8	10
	50	6	7	9
	60	5	6	8
	70	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	20	-	11	16
	30	7	10	14
	40	7	9	12
	50	6	8	10
	60	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	30	8	9	11
	40	7	8	10
	50	6	7	9
	60	5	6	8
Minor Thoroughfares*	20	9	12	14
	30	9	11	12
	40	9	10	12
	50	7	8	10
	60	6	7	9
	70	5	6	7
Local Streets*	20	-	11	16
	30	7	10	14
	40	7	9	12
	50	6	8	10
	60	5	6	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters (100 ft) each way from intersections (measured from edge of pavement) should not exceed 5%.

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* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.
(Reference NCDOT Roadway Design Manual page 1-12 T-3)

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE TABLE E (METRIC)					
Design Speed (km/h)	30	50	60	90	100
Stopping Sight Distance					
Minimum (meters)	29.6	57.4	74.3	131.2	157.0
Desirable (meters)	30	70	90	170	210
Minimum K* Value for:					
Crest curve	3	9	14	43	62
Sag curve	4	11	15	30	37
Passing Sight Distance:					
Minimum Passing Dist for two lanes, in m	*	*	*	*	*

(General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.)

* Currently under revision.

(Reference NCDOT Roadway Metric Design Manual page 1-12 T-1)

SIGHT DISTANCE TABLE F (ENGLISH)				
Design Speed, MPH	30	40	50	60
Stopping Sight Distance:				
Minimum (ft.)	200	275	400	525
Desirable (ft.)	200	325	475	650
Minimum K* Value for:				
Crest Curve	30	60	110	190
Sag Curve	40	60	90	120
Passing Sight Distance:				
Minimum Passing Distance for 2 lanes, in feet	1,100	1,500	1,800	2,100

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)

(Reference NCDOT Roadway Design Manual page 1-12 T-1)

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* K: a coefficient by which the algebraic difference in grade may be multiplied to determine the vertical curve length providing the desired sight distance. Sight distance provided for stopped vehicles at intersections should agree with "A Policy on Geometric Design of Highways and Streets, 1990".

4. Superelevation Tables G & H show the minimum radius and the related maximum superelevation (e) for design speeds. Maximum rate of e for rural rds. with no curb and gutter is 0.08. Maximum rate of e for urban sts. with curb and gutter is 0.06; 0.04 is desired.

SUPERELEVATION TABLE G (METRIC)		
Design Speed	Maximum e*	Minimum Radius m
50 km/h	0.04	100
65	0.04	175
80	0.04	280
100	0.04	490
50	0.06	90
65	0.06	160
80	0.06	250
100	0.06	435
50	0.08	80
65	0.08	145
80	0.08	230
100	0.08	395

e = rate of roadway superelevation, meter per meter

SUPERELEVATION TABLE H (ENGLISH)			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30 mph	0.04	302	19 00′
40	0.04	573	10 00′
50	0.04	955	6 00′
60	0.04	1,637	3 45′
30	0.06	273	21 00′
40	0.06	521	11 15′
50	0.06	955	6 45
60	0.06	1,432	4 15′
30	0.08	260	22 45′
40	0.08	477	12 15′
50	0.08	819	7 30′
60	0.08	1,146	4 45′

* e = rate of roadway superelevation, foot per foot
(Reference NCDOT Roadway Design Manual page 1-12 T-6 thru T-8)

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than 65 degrees.
2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.
3. Offset intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 61 m (200 ft) between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than 150 m (500 ft) in length. The distance form the edge of pavement on the vehicular turnaround to the R/W line should not be less than the distance from the edge of pavement to the R/W line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivision unless necessitated by unusual circumstances.
2. The width of an alley shall be at least 6.1 meters (20 ft).
3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the dead end as may be required by the Planning Board.

F. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

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G. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of 9.2 m (30 ft) from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 m (6 ft) from the face of curb.

H. Wheelchair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations repairs correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided an at other major points of pedestrian flow.

I. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2-lane, 2-way traffic should be as follows:
   a. Shoulder section approach
      1. Under 800 ADT design year
      Minimum 8.5 m (28 ft) width face to face of parapets of rails or pavement width plus 3.1 m (10 ft), whichever is greater.
      2. 800-2000 ADT design year
      Minimum 10.4 m (34 ft) width face/face of parapets, rails or pavement width plus 3.7 m (12 ft), whichever is greater.
      3. Over 2000 ADT design year
      Minimum width of 12.2 m (40 ft), desirable width of 13.4 m (44 ft) width face to face to parapets or rails.
   b. Curbs and gutter approach
      1. Under 800 ADT design year
      Minimum 7.3 m (24 ft) face to face of curbs.
      2. Over 800 ADT design year
      Width of approach pavement measured face to face of curbs. Curb and gutter sections used on roadway approaches: curbs on bridges shall match the approaches curbs in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 0.5 m (1.5 ft) minimum, or greater if sidewalks are required.
2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes servicing undivided two-way traffic should be as follows:
   a. Shoulder section approach: Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m (8 ft) minimum, 3.1 m (10 ft) desirable.)
   b. Curb and gutter approach: Width of approach pavement measured face to face of curbs.